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Cover

Nuytsia floribunda (Labill.) R. Br. ex Fenzl (Loranthaceae) – the Western Australian Christmas Tree is one of the few arborescent mistletoes in the world. This endemic tree is a semi-parasite common in sandy soil from the Murchison River to Israelite Bay. The journal is named after the plant, which in turn commemorates Pieter Nuijts, an ambassador of the Dutch East India Company, who in 1627 accompanied the “Gulde Zeepard” on one of the first explorations along the south coast of Australia.

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New species and notes on central Australian *Goodenia* (Goodeniaceae)

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Abstract

Albrecht, D.E. New species and notes on central Australian *Goodenia* (Goodeniaceae). *Nuytsia* 15(1): 1–9 (2002). *Goodenia halophila* Albr. *sp. nov.* and *G. cylindrocarpa* Albr. *sp. nov.* are described, with notes on their distribution, conservation status, habitat and relationships with other species of *Goodenia* Sm.. Notes are also provided on the Northern Territory populations of *G. angustifolia* Carolin and *G. glandulosa* K.Krause, and on all populations of *G. anfracta* J.M.Black and *G. maideniana* W.Fitzg. Further studies are needed to establish whether *G. anfracta*, which currently has conservation priority in Western Australia, should be reduced to synonymy under *G. maideniana*.

Introduction

In the course of preparing a checklist of the vascular plants of the southern part of the Northern Territory (Albrecht *et al.* 1997), it became apparent that the treatment of *Goodenia* Sm. (Goodeniaceae) in “Flora of Australia” (Carolin 1992) needed updating for the central Australian region. Two undescribed species of *Goodenia* section *Porphyranthus* G.Don occur within this region and were listed informally by Dunlop *et al.* (1995). Both species are known from few localities, and to facilitate their recognition and protection they are here described. Notes are also provided for several other central Australian species of *Goodenia*, including two not previously recorded by Carolin (1992) for the Northern Territory.

Materials and methods

The terminology adopted mostly follows that used in the most current and comprehensive treatment of *Goodenia* by Carolin (1992). In the two species described here the inflorescences have structures that closely resemble bracteoles in general appearance but frequently have axillary flowers. Following Briggs & Johnson (1979), who interpret bracteoles as two distal “empty” phyllomes (i.e. leaf-organs lacking axillary buds or such buds not developing further) on an axis terminating a flower, I have used ‘opposite or sub-opposite bracts’ rather than ‘bracteoles’ to describe this situation.

The term floral tube has been used to describe the structure consisting of the fused portions of the corolla, calyx and filament bases that are adnate to the ovary.

Floral descriptions are based on spirit or rehydrated material. Corolla length is measured as the distance between the line where the corolla tube abscises from the floral tube and the tip of central abaxial corolla lobe.

New species descriptions

***Goodenia cylindrocarpa* Albr., sp. nov.**

Goodenia lamprospermae F. Muell. affinis sed historia vitae annua, corolla minori et sacco anterioro corollae obscuro, stylo brevior, lobis calycis longioribus, capsulis largioribus non-abscissis prompte differt.

Typus: 10 km north-north-east of Connells Bore (Pictorella Swamp), Northern Territory, 30 June 1982, P.K. Latz 9109 (*holo*: DNA A69693; *iso*: NT).

Erect annual *herb* to c. 25 cm high, vegetative parts glabrous or with tiny inconspicuous simple hairs and gland-tipped trichomes, longer septate hairs present in leaf and bract axils. *Leaves* in a basal tuft, persistent, flat, oblanceolate, obovate or spatulate, 20–85 mm long (including a contracted petiole-like base 5–50 mm long), 3.5–20 mm wide, dentate or rarely subentire, apex acute. *Flowers* arranged in bracteate panicle-like inflorescences composed of cymose part-inflorescences; bracts leaf-like in lower part of inflorescence becoming reduced towards distal parts, those below flowers opposite or sub-opposite and resembling bracteoles, linear; pedicels to c. 10 mm long, an articulation line not evident in flowering specimens but sometimes apparent c. 0.5–1 mm below the pedicel-floral tube junction in fruiting specimens. *Floral tube* obconical, glabrous or with tiny inconspicuous simple hairs and gland-tipped trichomes; calyx lobes linear-lanceolate, 2.5–4 mm long, attached in the upper half or third of the floral tube. *Corolla* yellow, sometimes faintly purple-tinged in dried specimens, 5–6.5 mm long, with simple hairs and gland-tipped trichomes externally and few simple hairs internally, without enations, anterior pouch obscure; abaxial lobes with equal wings c. 0.5 mm wide on either side, the 2 auriculate adaxial lobes separated lower and unequally winged. *Anthers* 0.7–0.9 mm long post dehiscence, apiculate. *Ovary* with a dissepiment almost as long as the loculus and bearing numerous (c. 120 per locule) ovules scattered over placentas; style 2.5–3 mm long, almost straight to weakly s-shaped, sparsely hairy; indusium obtriangular, 1–1.1 mm wide, with scattered hairs particularly on adaxial side, ciliate on straight distal abaxial edge, the distal adaxial edge usually glabrous but with hairs from the indusium face extending beyond the edge. *Fruit* cylindrical, 7–9 mm long, 2–3 mm wide, dehiscing through two entire valves that are raised 2–3 mm beyond the attachment point of calyx lobes. *Seeds* lenticular, brown, elliptic to ovate, 0.7–0.8(1) mm long, 0.5–0.7 mm wide, very faintly reticulate-foveate, glossy, with a narrow transparent wing 0.05–0.1 mm wide. (Figure 1A)

Selected specimens examined. NORTHERN TERRITORY: Toko Range, above Alcoora Spring, 23 Mar. 1995, D.E. Albrecht 6359 & P.K. Latz (BRI, DNA, NT); Creswell Downs Station, 11 July 2000, C. Materne s.n. (NT); 7 km S of Dunmarra, 8 June 1975, D. Symon 10357 (AD, SYD); Connells Lagoon Reserve, 24 Aug. 1989, B.G. Thomson 3334 (DNA).



Figure 1. A – Specimen of *Goodenia cylindrocarpa* (D.E. Albrecht 6359, NT 90786). B – Specimen of *G. halophila* (D.E. Albrecht 7948, NT 94082).

Distribution and conservation status. *Goodenia cylindrocarpa* is apparently endemic in the Northern Territory, but is likely to occur in arid or semi-arid Queensland. It is presently known from four disjunct populations (Figure 2A), two of which occur in the Mitchell Grass Downs bioregion and one each from the Sturt Plateau and Channel Country bioregions. Suitable habitat occurs between the known sites and additional populations are likely to be located in the intervening areas. One of the populations in the Mitchell Grass Downs bioregion occurs within the Connells Lagoon Conservation Reserve. There is presently too little information to assess the size of populations, reservation status and threats. As a tentative measure *Goodenia cylindrocarpa* is assigned a risk code of 3KC.

Habitat and ecology. All known populations occur on heavy clay soil in areas subject to seasonal inundation. On the Barkly Tablelands it occurs in *Chenopodium auricomum*-dominated swamps and drainage lines. On the Toko Range it has been found in a grassy perched swamp on a heavy soil plateau.

The presence and relative abundance of plants at a particular site each year appears to be dependant on the amount of rainfall (G. Allan pers. comm.). An attempt to relocate *Goodenia cylindrocarpa* in 1995 at one of the previous collection sites (Dunmarra) was unsuccessful, presumably because of inadequate rain. The original specimen from this site (Symon 10357) was collected during a year of exceptional rainfall.

Phenology. Flowering specimens have been collected between March and June, and fruiting specimens between March and August.

Etymology. The compound Latin/Greek specific epithet is descriptive of the cylindrical (torpedo-shaped) fruit.

Notes. *Goodenia cylindrocarpa* is the entity listed as *Goodenia* D70208 Barkly by Dunlop *et al.* (1995) and Albrecht *et al.* (1997). Despite its rather wide geographic range there appears to be little morphological variation except for plant size.

Having yellow corollas and numerous ovules scattered over the placentas, *Goodenia cylindrocarpa* is placed in the section *Porphyranthus*. It has been confused with *G. lamprosperma* F.Muell., but differs from that species in being an annual rather than perennial herb, in having smaller corollas (5–6.5 mm long, cf. (7)8–11 mm long) lacking a visible anterior pouch, shorter styles (c. 3 mm long, cf. 4.5–7 mm long), longer calyx lobes (2.5–4 mm long, cf. 1.5–2 mm long) and larger capsules (7–9 mm long, cf. 3–6 (7) mm long) that do not readily abscise. *G. cylindrocarpa* also bears some resemblance to *G. berringinensis* Carolin, particularly with regard to the fruit, but that species has a conspicuous indumentum of soft spreading hairs, a broader indusium (1.3–1.5 mm wide, cf. 1 mm wide) and larger corollas (c. 12 mm long) with enations, a conspicuous anterior pouch and broader wings.

***Goodenia halophila* Albr., sp. nov.**

Goodenia modestae J.M.Black affinis sed fructibus 2- (non 4-) valvibus, seminibus minoribus distortis non-alatis vel ala angustissima, marsupio nectarii obscuro, stylo brevior differt.

Typus: 9 km east of Rabbit Flat, Northern Territory, 7 July 1980, P.K. Latz 8459 (*holo:* DNA A63763; *iso:* MO, NSW, PERTH).

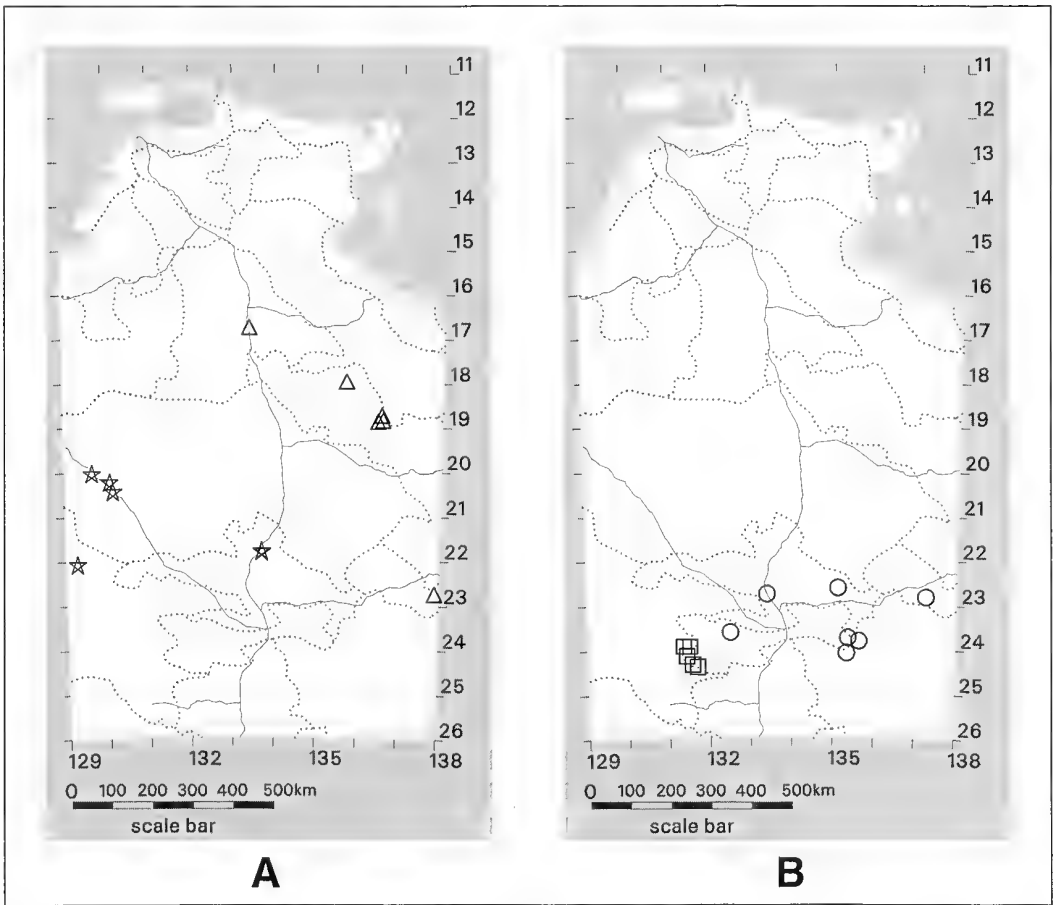


Figure 2. Distribution maps, with major roads and bioregional boundaries (Thackway & Cresswell 1995) shown. A – *Goodenia cylindrocarpa* (Δ) and *G. halophila* (\star) in the Northern Territory based on herbarium records from AD, DNA, NT & SYD. B – *Goodenia angustifolia* (\circ) and *G. glandulosa* (\square) in the Northern Territory based on herbarium records from DNA and NT.

Delicate annual *herb* with a basal tuft of leaves and erect or decumbent flowering stems to 35 cm long; vegetative parts with an inconspicuous indumentum of sparse minute simple hairs and gland-tipped trichomes, becoming glabrous with age, hairs \pm denser in leaf and bract axils. *Leaves* mostly in a basal tuft; basal leaves persistent but sometimes dead at fruiting stage, flat, spatulate to oblanceolate, 7–60 mm long, 2–18 mm wide, pinnatifid, dentate or rarely subentire, base tapered so that petiole rarely distinguishable, apex obtuse to acute; cauline leaves similar but smaller, grading into bracts. *Flowers* arranged in cymose part-inflorescences along the usually zig-zag stems, the whole inflorescence occupying most of the plant; bracts leaf-like in lower part of inflorescence, reducing to linear-lanceolate and \pm concave towards distal parts, those below flowers opposite or sub-opposite, slightly fleshy and resembling bracteoles; pedicels thread-like, curved, to c. 10 mm long, articulate c. 0.5–1.5 mm below the pedicel-floral tube junction. *Floral tube* obconical, glabrous; calyx lobes lanceolate, 1.7–2.5(3) mm long. *Corolla* yellow, the midvein and/or auricle of the 2 adaxial lobes sometimes purple-tinged or flecked, 7–10 mm long, with sparse minute simple hairs and rarely also gland-tipped trichomes externally, glabrous internally or with sparse minute simple hairs towards base of tube, without enations,

anterior pouch obscure; abaxial lobes with equal wings c. 0.8–1.5 mm wide on either side, the 2 auriculate adaxial lobes separated lower and unequally winged. *Anthers* c. 1.5 mm long in bud, 0.8–1.2 mm long post dehiscence. *Ovary* with a dissepiment two-thirds to almost as long as the loculus and bearing numerous ovules scattered over placentas; style purple, 2.7–3.5 mm long, more or less straight, glabrous or villous distally; indusium purple, obtriangular to almost square, sides convex, c. 1.5 mm wide, with scattered hairs, ciliate on the concave or straight distal edges, the hairs along the abaxial edge longer than those on the adaxial edge. *Fruit* ellipsoid to narrowly ovoid, 3–4 mm long, 1.7–2 mm wide, splitting into two valves that are raised c. 1.5 mm beyond attachment point of calyx lobes, dehiscing septicidally. *Mature seeds* not seen; immature seeds brown, asymmetrically orbiculate-ovate or elliptic, distorted, c. 0.4–0.5 mm diam., minutely and densely papillate, usually with a rudimentary narrow wing < 0.05 mm wide. (Figure 1B)

Other specimens examined. NORTHERN TERRITORY: Stirling Station, 12 Aug. 1996, D.E. Albrecht 7948 (NT); cultivated, Arid Zone Research Institute, 11 Nov. 1996, D.E. Albrecht 7965 (NT); Tanami track, 27 km NW of the Granites, 20 May 1976, A.C. Beauglehole 50934 (SYD); 12 mi [19 km] SE of Rabbit Flat, 17 July 1973, P.K. Latz 3947 (DNA); 8 km E of NW corner of Lake Mackay, 6 Oct. 2001, P.K. Latz 18187 (NT, AD, PERTH); N of Tanami, 1973, C. Lendon 20 (DNA); Stirling Station, 3 July 1974, A. Mitchell 46 (DNA).

Distribution and conservation status. At present *Goodenia halophila* is known only from arid regions of the Northern Territory, but it is extremely likely to occur in adjacent areas of Western Australia. Five populations are currently known (Figure 2A); three occur in the Tanami bioregion and one each in the Burt Plain and Great Sandy Desert bioregions. The species occurs within a region that is relatively poorly surveyed and it is difficult to predict its actual distribution. No populations occur within a gazetted biological reserve. Presently there is too little information to assess the size of populations and threats. Further field work after good rains will help to resolve the conservation status of this species and as a tentative measure *Goodenia halophila* is assigned a risk code of 3K.

Habitat and ecology. All known populations occur in low-lying saline or semi-saline areas associated with seasonal lakes or paleodrainage line systems. Soils range from sandy loam to sandy clay, and the pH at one site tested (Stirling Swamp) is 10. Associated species include *Frankenia cordata*, *Eragrostis dielsii*, *Heliotropium curassavicum*, *Triglochin hexagonum*, *Atriplex holocarpa* and *Triodia salina*.

The presence and relative abundance of plants at a particular site each year appears to be highly dependant on the amount of rainfall. Attempts to relocate the species from known locations in the Western Tanami in 1996 were unsuccessful because of the lack of rain. In contrast, *G. halophila* appeared in profusion at Stirling Swamp following exceptional rainfall in early 2000.

Phenology. Flowering and fruiting specimens have been collected between May and August. Under glasshouse conditions in Alice Springs transplants from Stirling Swamp flowered continuously from July 2000 to February 2001 (plants still alive and flowering but becoming senescent at this time).

Etymology. The specific epithet is derived from Greek *halo-*, salt, and *phileo*, I love, referring to the habitat preference for saline or semi-saline environments.

Notes. *Goodenia halophila* is the entity listed as *Goodenia* A44284 (subsaline) by Dunlop *et al.* (1995) and Albrecht *et al.* (1997).

Like *Goodenia cylindrocarpa*, *G. halophila* belongs to section *Porphyranthus*. *Goodenia halophila* is closely allied to *G. modesta* J.M.Black, in which it was included by Carolin (1992). *G. halophila* differs from *G. modesta* in the mode of dehiscence of the fruit (2-valved, cf. 4-valved), the smaller seeds (0.4–0.5 mm long, cf. (0.6)0.7–0.8(1) mm long), the obscure nectary pocket, and shorter style (2.7–3.5 mm long, cf. 4–5 mm long). In addition *G. halophila* has a more delicate disposition, the flowering stem axes are more distinctly zig-zag, the calyx lobes are generally shorter (1.7–2.5 (3) mm long, cf. (2)2.5–3.5(4.5)), the pedicels are strictly thread-like (c. 0.1(1.5) mm wide at midpoint, cf. (0.1)0.15–0.3 mm wide at midpoint) and the habit strictly annual (cf. perennial or perhaps rarely annual). *G. halophila* also occurs in saline or semi-saline drainage systems and lakes, whereas *G. modesta* is associated with seasonally moist non-saline habitats.

Goodenia halophila also bears a superficial resemblance to the recently described *G. gypsicola* Symon (Symon 2000), particularly with respect to the zig-zag inflorescences and fine pedicels. However *G. gypsicola* is readily distinguished by the perennial habit, pale blue corollas, smaller fruit 1.5–2.8 mm long and thicker seeds.

Goodenia halophila exhibits little variation in floral and fruit characters, though plant size, leaf dimensions and the degree of branching of part-inflorescences are rather variable. The variation in these latter characters appears to be correlated with the availability of water during the growing season. Specimens collected at Stirling Swamp during the exceptionally wet year of 1974 are robust with large leaves and much branched part-inflorescences, whereas specimens collected in 1996 from the same site but during a period of relatively low rainfall are of a much smaller stature with smaller leaves and less branched part-inflorescences. Seedlings transplanted from Stirling Swamp in 1996 and grown in irrigated containers developed into robust plants with large leaves and much branched part-inflorescences.

Notes on other central Australian species

Goodenia angustifolia Carolin

At the time the treatments of Carolin (1980, 1992) were being prepared, *Goodenia angustifolia* was only known from the type collection in south-western Queensland. Since that time additional collections from south-west Queensland and the central eastern part of arid Northern Territory (Figure 2B) have been made. Carolin's descriptions require amendment to accommodate the level of variation observed in Northern Territory populations. Bracteoles are present or absent in Northern Territory populations, leaves are mostly terete but occasionally some have a channel on the upper surface, the corolla length ranges from 10 to 16 mm (cf. 10–12 mm long in descriptions) and its external surface is either glabrous or the tube has scattered hairs. The Northern Territory populations occur in open situations on soils with a stony (typically quartz) surface layer. This habitat preference is consistent with known locations in Queensland.

Specimens examined. NORTHERN TERRITORY: Namatjira Drive, 50 m W of the Redbank Gorge turnoff, 20 Oct. 1999, D.E. Albrecht 8987 (NT); Stuart Highway, 116 km N of Alice Springs, 18 Oct. 2000, D.E. Albrecht 9439 (NT); 7 km S of Casey Bore, 2 June 1995, D.E. Albrecht 6729 & P.K. Latz (BRI, DNA, NT); MacDonald Downs, 22 Oct. 1974, P.K. Latz 5773 (CANB, DNA, NSW); 33 km NE of Numery Homestead, 16 Sep. 1993, P.K. Latz 13383 (DNA, NT); Marqua Station, 25 May 1972, P.K. Latz 2621 (CANB, NSW, NT).

QUEENSLAND: near railway crossing, 5 km N of Malbon Vale Homestead, Oct. 1984, V.J. Neldner 1627 (BRI); 6 km N of Malbon, Oct. 1984, V.J. Neldner 1615 (BRI); c. 27 km E of 'Cluny', 10 Sep. 1978, R.W. Purdie 1447 (BRI, DNA).

***Goodenia glandulosa* K.Krause**

Carolin (1992) records the distribution of *Goodenia glandulosa* as Western Australia and South Australia. The species is here reported to occur in the Northern Territory (Figure 2B), where a small number of collections have been made within about a 100 km radius of Kings Canyon (Watarrka) and a further occurrence noted by the author west of Docker River near the Western Australian border (unmapped). The Northern Territory populations occur on low sand dunes and in swales with *Triodia schinzii*. This habitat is atypical for the species which is reported to occur usually on rocky hillsides (Carolin loc. cit.).

Goodenia glandulosa warrants further study as it appears to be a variable species, particularly with respect to corolla size (5–11 mm long, cf. 8–11 mm in Carolin's description), the width of corolla lobe wings and the presence or absence of bracteoles. The populations near Kings Canyon have corollas at the smaller end of the size range (i.e. 5 mm long). *Goodenia glandulosa* has a rather distinctive stem and leaf indumentum consisting of mostly ascending arcuate swollen-based hairs overlying gland-tipped trichomes of variable density. The glandular trichomes are not conspicuous and the plants are neither viscid or varnished on younger parts. Consequently specimens of this species can not be determined accurately using the key provided by Carolin (1992).

Selected specimens examined. NORTHERN TERRITORY: 12 km W of Mereenie base camp, 21 Nov. 2000, D.E. Albrecht 9499 & P.K. Latz (NT); NW Kings Canyon, 8 Nov. 1976, P.K. Latz 6662 (NT); Bore Rd, Watarrka, 25 Aug. 1988, D. Schunke 237 (NT).

***Goodenia anfracta* J.M.Black and *G. maideniana* W.Fitzg.**

The type specimens of *Goodenia anfracta* (from Cootanoorina, South Australia) and *G. maideniana* (from Nannine, Western Australia) look grossly dissimilar, largely because of the difference in shape of the cauline leaves (linear in *G. anfracta*, obovate in *G. maideniana*) and the pronounced zig-zag stems on the type of *G. anfracta*. These distinguishing characteristics were emphasised by Carolin (1992) who treated them as distinct species.

Several specimens from South Australia more or less match the type of *G. anfracta* but none from there match the type of *G. maideniana*. In the Northern Territory there is only a single specimen from Lake Bennett that more or less matches the type of *G. anfracta*. All other specimens from the Northern Territory are unlike the types of both taxa, having cauline leaves that are oblanceolate grading to linear towards the distal end of the stems. No Northern Territory material has obovate cauline leaves as in the type of *G. maideniana*. Western Australian material is variable, including specimens matching the types of both of the named species as well as specimens with intermediate features similar to those in the Northern Territory. *G. anfracta* is currently listed as having a high (Priority One) conservation status in Western Australia, as only a few specimens close to the eastern border of the State match the type of this taxon.

Comparing Carolin's (1992) descriptions of *G. anfracta* and *G. maideniana* suggests that several additional characters may be helpful for distinguishing these species. However after examining the types

and specimens matching the types of both species, it became apparent that most of the characters in question (i.e. branch length, pedicel length, corolla length and the length of the adaxial corolla lobes) have almost completely overlapping ranges rather than non-overlapping ranges. As the type of *G. maideniana* lacks fruit and all other Western Australian specimens matching the type of *G. maideniana* also lack fruit, it is not possible to determine whether fruit shape and the relative length of the ovary septum to total ovary length have non-overlapping ranges.

Specimens assigned to either species have been collected from mound springs and salt lakes. The commonality in habitat, and variability in floral and vegetative morphology suggest that perhaps only a single variable species is involved. Further collections from plants matching the type of *G. maideniana* are required, particularly with ripe fruit and seed. Study of intra-population variation is also required. The status of these two taxa is likely to remain unresolved until these tasks are undertaken.

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A revision of *Byblis* (Byblidaceae) in south-western Australia

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Abstract

Conran, J.G., Lowrie, A. and Moyle-Croft, J. A revision of *Byblis* (Byblidaceae) in south-western Australia. *Nuytsia* 15(1): 11–19 (2002). The south-western Australian populations of *Byblis* (Byblidaceae) are revised. A new species, *B. lamellata* Conran & Lowrie, is recognised on habit, ecology and seed morphology and named for the populations between Arrowsmith River and Cataby. *Byblis gigantea* Lindl. and its synonym *B. lindleyana* Planch. are lectotypified. A generic description and a table of distinguishing features for all species is given. A key and distribution map are provided for the two species from the south-west of Western Australia.

Introduction

The genus *Byblis* (Byblidaceae) currently consists of five species; four annual species from northern Australia (Lowrie & Conran 1998) with *B. liniflora* extending to southern New Guinea, and a single perennial species *B. gigantea* from two disjunct regions in south-western Australia. Investigation of the populations of *B. gigantea* in the field, as well as studies of seed morphology of these populations and within the genus as a whole, suggested that the populations from the two disjunct regions differed in a number of habit, ecological and seed morphological characteristics, despite their overall similarity in gross and floral morphology. In particular, the seeds of *B. gigantea* from the two regions differed from each other more than did seeds of the other species within the genus. As seed morphology is a useful character at the species level in *Byblis*, we concluded that *B. gigantea*, as currently recognised, represents two species.

The aims of this study were to determine the degree of morphological and ecological differences between populations of *B. gigantea* from the two regions, and to resolve the nomenclature and typification of these taxa.

Materials and methods

Field studies of the south-western *Byblis* populations were variously undertaken by Allen Lowrie and John Conran between 1988 and 1999. In addition, herbarium specimens lodged at PERTH and AD were examined, as was type material and associated collections held at K and BM. Wild-collected seed of populations of *B. gigantea* from the Perth region (A. Lowrie 566, 1675 (PERTH)) and the region between Arrowsmith River and Cataby (A. Lowrie 798, 1672 (PERTH)) were examined under SEM and

stereo dissecting microscope. To allow for comparisons with the other species in the genus, seed samples from *B. aquatica* (A. Lowrie 2264, 2276 from the Northern Territory (PERTH)), *B. filifolia* (A. Lowrie 722, 1177, 1199, 1233, 1249, 1326, 1329, 1395, 1425, 1498, 1715, 1721, 1754, 1762, 1781, 2041 from the Kimberley region (PERTH)), *B. liniflora* (J.G. Conran s.n. Atherton Tableland, W.A. Travers s.n. Cardwell State Forest in Queensland (ADU)) and *B. rorida* (A. Lowrie 1394, 1405, R.L. Barrett 595 from the Kimberley region (PERTH)) were also examined.

Morphological descriptions were based on fresh, dried and spirit material.

Taxonomic treatment

Byblis Salisb., *Parad. Lond.* 2: t. 95 (1808). Type: *Byblis liniflora* Salisb.

Carnivorous *shrubs* regenerating each year from a subterranean rhizome, or *ephemeral herbs* with fibrous roots. *Stems* simple to branched, short-lived and elongating at flowering, erect, scrambling or floating. *Leaves* cauline, alternate, exstipulate, subulate-linear, with sticky glandular hairs and an apical swelling. *Flowers* solitary in upper leaf axils, hermaphrodite, regular, rotate. *Sepals* 5, fused basally, imbricate, persistent. *Petals* 5, fused basally but appearing free, 5-lobed. *Stamens* 5, opposite the sepals, inserted at the base of the tube; filaments free, twisted to face abaxially; anthers basifixed, 2-thecate, 4-sporangiate, introrse, opening by pore-like short apical slits. *Ovary* superior, 2-locular; ovules numerous, axile. *Style* curved-filiform, stigma minutely capitate or bilobed. *Fruit* a smooth, loculicidal capsule. *Seeds* small, angular, black, prominently sculptured with smooth or denticulate ridges; endosperm starchy; embryo small, linear.

Size and distribution. A genus of six species from northern and south-western Australia, a single species extending to New Guinea. Figure 1 is a generalised distribution map of the south-western Australian taxa.

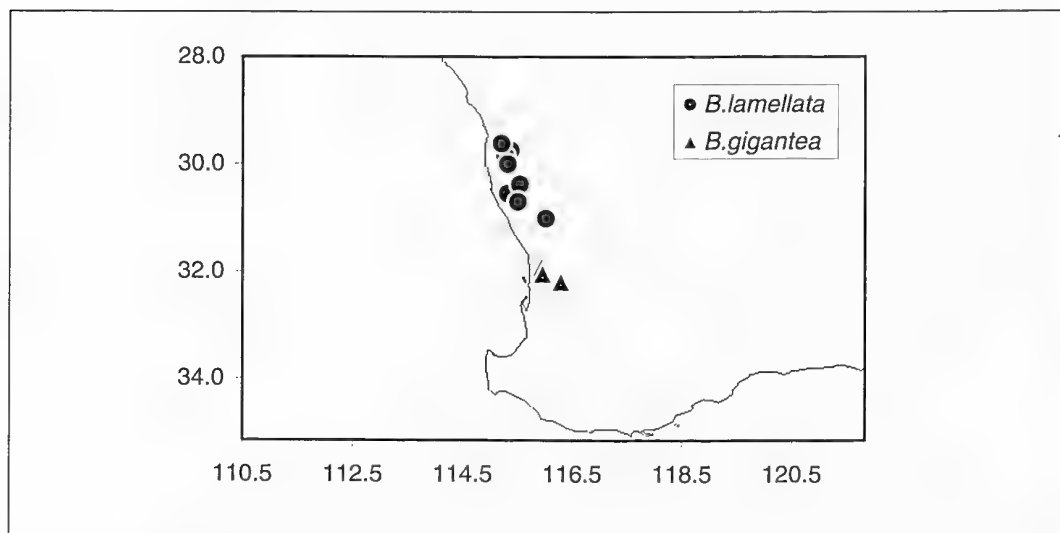


Figure 1. Generalised distribution map of *Byblis* in south-west Western Australia.

Table 1. Morphological and ecological comparisons of *Byblis* species. Numbers in brackets are means.

	<i>B. gigantea</i>	<i>B. lamellata</i>	<i>B. liniflora</i>	<i>B. filifolia</i>	<i>B. aquatica</i>	<i>B. rorida</i>
Plants						
habit	perennial sub-shrub	perennial sub-shrub	annual herb	annual herb	annual herb	annual herb
fire regrowth response	resprouting mainly from rhizome	resprouting from aerial shoots and rhizome	seed	seed	seed	seed
Seeds						
length	0.6–1.5 mm (1. mm)	1.0–1.8 mm (1.3 mm)	0.5–0.9 mm (0.7 mm)	0.4–1.1 mm (0.7 mm)	0.9–1.3 mm (1.0 mm)	0.5–0.8 mm (0.6 mm)
width	0.6–1.0 mm (0.8 mm)	0.8–1.5 mm (1.1 mm)	0.4–0.6 mm (0.5 mm)	0.3–0.8 mm (0.5 mm)	0.4–0.7 mm (0.6 mm)	0.4–0.6 mm (0.5 mm)
longitudinal ridges	with massive processes	with massive processes	minutely denticulate-crenulate	denticulate	smooth, prominent	minutely denticulate
transverse ridges	shallow	shallow	shallow	deep	absent	shallow
sculpturing	processes muricate	processes lamellate	tuberculate-verrucate	smooth	smooth	irregularly roughened
ribbing of processes	prominent, irregular	prominent, regular	n/a	n/a	n/a	n/a
pore length	68–125 µm (89 µm)	59–112 µm (76 µm)	73–165 µm (119 µm)	57–178 µm (120 µm)	114–150 µm (130 µm)	54–74 µm (66 µm)
pore width	24–53 µm (36 µm)	25–34 µm (28 µm)	68–104 µm (88 µm)	42–132 µm (82 µm)	10–78 µm (66 µm)	52–65 µm (60 µm)
periclinal pore wall	smooth	smooth	foveolate	foveolate	smooth	smooth

Notes. The differences in seed sculpturing, habit and apparent fire regrowth response between the different *Byblis* species and the two *B. gigantea* morphs are detailed in Table 1 and representative seeds of each taxon are illustrated in Figure 2. Based on a comparison of the degree of difference between the seeds of the northern (Figure 2A) and southern (Figure 2B) *B. gigantea* morphs alone, it is clear that they more different from each other than most of the accepted species which form the *B. liniflora* complex (Figure 2C–F). This, combined with their geographic separation, different regrowth responses after fire and different habitat requirements supports the separation of the northern and southern morphs into separate species.

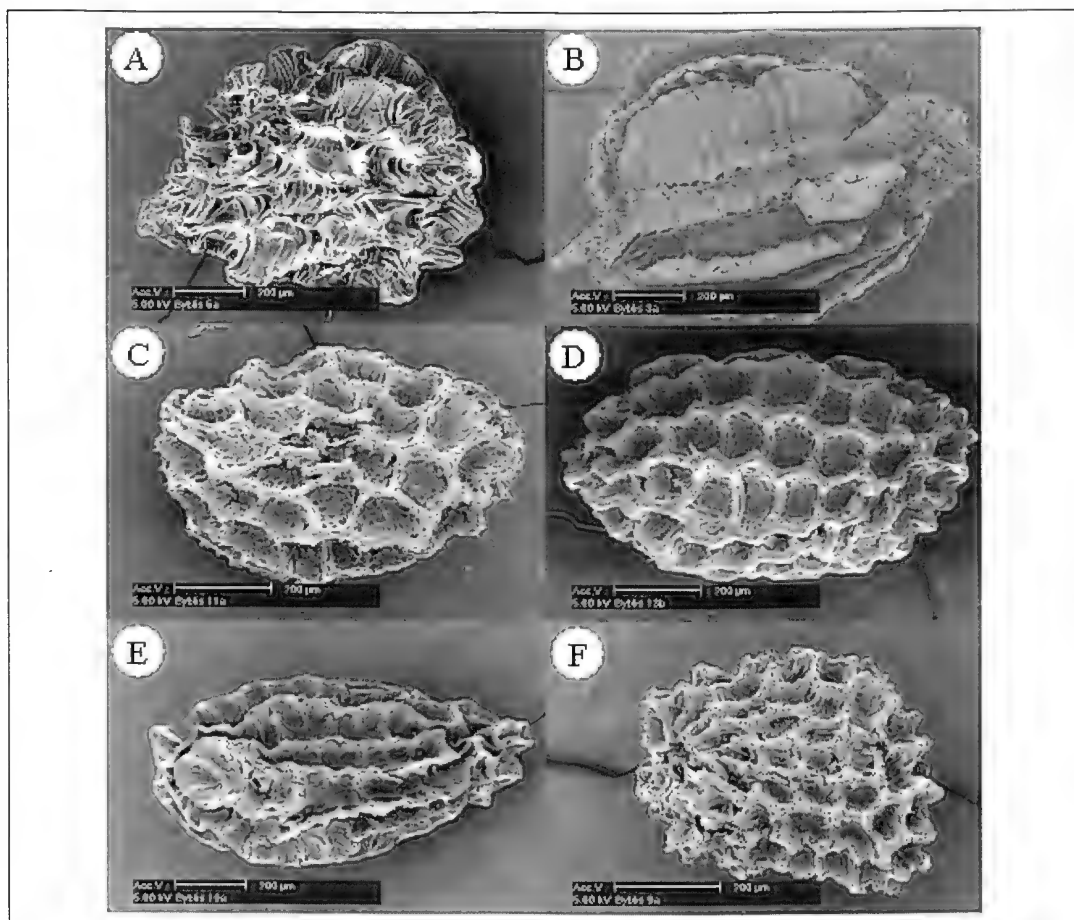


Figure 2. SEM micrographs of seeds of *Byblis* species. A – *B. gigantea*, A. Lowrie 1681 (PERTH); B – *B. lamellata*, A. Lowrie 798B (PERTH); C – *B. liniflora*, A. Lowrie 1416 (PERTH); D – *B. filifolia*, A. Lowrie 1425 (PERTH); E – *B. aquatica*, A. Lowrie 2276 (PERTH); F – *B. rorida*, R. L. Barrett 595 (PERTH).

Key to the species of *Byblis* in south-western Australia

1. Seeds with strongly corrugated and ribbed sculptured plates; plants mainly
resprouting from rhizomes after fire ***B. gigantea***
- 1: Seeds with erect non-corrugated, weakly ribbed lamellar plates; plants
resprouting from aerial stems as well as rhizomes after fire ***B. lamellata***

Byblis gigantea Lindl., Sketch Veg. Swan Riv. Col. 21 (1839). *Type*: Swan River, N [New] Holland [Western Australia], no date, *Drummond s.n.* ex Herb. Lindl. in Herb. Hook. (*lecto*: K, here designated, left hand element; *isolecto*: K, right hand element); Swan River, 1939, *Drummond s.n.* ex Herb. Lindl. in Herb. Benth. (*isolecto*: K).

Byblis lindleyana Planch., *Ann. Sci. Nat. Bot. sér. 3*. 9: 307 (1848). *Type*: Swan River, N [New] Holland [Western Australia], no date, *Drummond s.n.* labelled "*Byblis grandiflora*" ex Herb. Lindl. in Herb. Hook. (*lecto*: K, here designated); Swan River, NH [New Holland], 1839, *Drummond s.n.* ex Herb. Lindl. in Herb. Benth. (*isolecto*: K).

Small branched *perennial sub-shrub* to c. 45 cm from a branched underground woody more or less rhizomatous base, aerial shoots rarely branched, more or less herbaceous, and generally short-lived. *Leaves* linear, to 20 cm long, lamina reniform in cross-section, marginally and abaxially glandular-hairy. *Pedicels* to 15 cm long, glandular-hairy. *Sepals* lanceolate, 8–15 mm long, 2.5–3.5 mm wide basally, abaxially glandular-hairy. *Petals* 15–20 mm long, glabrous, lobes obovate, to 15 mm wide, apically serrate, pink to cerise-mauve, rarely white. *Stamens* 5, filaments 2.5–3.5 mm long; anthers 5–6 mm long, yellow with a brown apex. *Ovary* spheroid, 1.5–2 mm long, \pm glabrous. *Style* 7–9 mm long, basally glandular. *Capsule* ovoid, 5–7 mm long, 3.5–4 mm wide. *Seeds* c. 1 mm long, with prominent longitudinal corrugate-sculptured and ribbed muricate processes. **Rainbow Plant** (Figure 2A)

Selected specimens examined. WESTERN AUSTRALIA: Guildford, Dec. 1901, *C. Andrews s.n.* (PERTH); Perth [precise locality withheld], 24 Aug. 1957, *C.L. Wilson* 864 (PERTH); sandy flats, lower Canning River, 4 Dec. 1901, *A. Morrison s.n.* (PERTH); Southern River [precise locality withheld] 11 Nov. 1991, *A. Lowrie* 518 (PERTH); Southern River, [precise locality withheld], 31 Dec. 1991, *A. Lowrie* 566; Brookton Highway, E of Albany Highway, 28 Dec. 1996, *A. Lowrie* 1675 (PERTH); Newburn, Perth, 28 Dec. 1996, *A. Lowrie* 1681A (PERTH); Newburn, Perth, 11 Dec. 2001, *A. Lowrie* 2736 (PERTH).

Distribution. Undoubtedly more widespread in the past. As a result of land clearing this species is now confined to four relatively small populations all more or less within the greater Perth region, mostly along the Canning River drainage system. Surveys are needed to determine whether there are other populations of this species in the region, or in other areas where it was known historically (e.g. Guildford). Similarly, the report by Erickson (1968) of *Byblis gigantea sens. lat.* extending from the Murchison River north of Geraldton south to the Murray River south of Perth and with population centres at the Hill, Moore and Canning Rivers requires investigation in view of the apparent absence of collections for either species across much of that area. Moore River in particular warrants investigation in view of its position between the current verified ranges of the two species. (Figure 1)

Habitat. *Byblis gigantea* grows in seasonally wet sandy-peat swamps in low *Leptospermum*/Restionaceae-dominated shrubland.

Flowering period. September to January.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. Although originally much more widespread and common, the species is now apparently absent over much of its former range. It is critically endangered from human activity, mostly due to urban expansion of the greater Perth area. At present, the species is known from a few small, isolated populations, only one of which is in a reserve. Further surveys are required urgently to determine the true extent of the remaining distribution of this species.

Etymology. The epithet is from the Latin *giganteus* – giant, with reference to the much larger size of this species relative to the previously recognised *Byblis liniflora*.

Lectotypification. There are two Drummond *Byblis* sheets at K labelled Herb Hook., only one of which corresponds to Planchon's description for *B. gigantea*. That specimen has two elements on the sheet, and the left hand piece has been selected as the lectotype, with the right hand element regarded as an isolectotype. The other Herb. Hook. sheet fits closely to Planchon's *B. lindleyana*, and has thus been designated as the lectotype for that epithet.

In addition there are two Drummond sheets at K labelled Herb. Benth., one for each of these taxa, which are listed above as isoelectotypes.

Affinities. Readily distinguished from *B. lamellata* by the muricately sculptured and irregularly ribbed seed ridges, the apparent lack of aerially resprouting shoots after fire, and its occurrence in seasonally swampy habitats.

Notes. The generally used common name Rainbow Plant is recommended for this species. De Buhr (1975) postulated mimicry by *Byblis gigantea sens. lat.* of *Thysanotus multiflorus* (Lilianaee: Laxmanniaceae) with which it co-occurs and co-flowers. Although both are buzz-pollinated, the identity of their pollinators and the pollination reward offered by each species is unknown (Erickson 1968). *B. gigantea* is found in seasonally waterlogged *Leptospermum*/Restionaceae low scrub (Speck & Baird 1984) and Erickson (1968) suggested that the aerial shoots were annual, dying back to the rootstock over summer. Baird (1984) found that following fire, *B. gigantea* survives by regenerating from the deep, woody perennial rootstock. In contrast, *B. lamellata* usually grows on deep silica sands in fire-prone dry heathlands, and is a taller branched shrub which resprouts from the above-ground stems after fire as well as from the rhizomes. However, as field observations suggest that *B. gigantea* plants from areas which have not had fire for extended periods can sprout aerially, further studies are needed to confirm the apparent post-fire differences between the taxa.

Planchon (1848) recognised two taxa within the *B. gigantea* complex, based largely on their stem elongation and sepal nervation as follows:

“*Byblis gigantea* Lindl. [Plant] tall, leafy, closely pedunculate (leaf bases closely spaced), and (especially under the flowers) erect; sepals 3-nerved; capsule somewhat subglobose, obtuse, with many faint nerves apically. Locality: Swan River Colony; herb. Lindl.; *Drummond s.n.* in herb. Hook.

Byblis lindleyana Planch. [Plant] tall, loosely leafy and almost all pedicels erect-patent, especially under the flowers where they are very wide-spreading; sepals 5-nerved; capsule ovate, acuminate, conspicuously multi-nerved apically. Locality: same as the previous [i.e. Swan River Colony]; herb. Lindl.; *Drummond s.n.* in herb. Hook. More robust than the preceding species [and] with fewer leaves. Plants sprinkled with short glandular hairs. Trunk rhizomatous, horizontal, not emerging out of the ground, short, thick, with spongy bark, decorticating with age, somewhat woolly (sub-flocculose), pale orange. Stems continuous with the rhizome, erect, about 2 feet long, simple, leafy at the base, alternate, more or less spreading to erect, distinguished by being more sparsely leafy with widely spaced axils, revealing the leaf bases and their single-flowered peduncles. Leaves slightly thickened at the base, filiform, compressed-terete, apex slightly clavate and unarmed [= eglandular], lower leaves 9–12 inches long, intermediate [= stem leaves?] 5–7 inches long, those under the peduncles shorter, ebracteate. Sepals basally lanceolate, long-attenuate apically, slightly clavate, unequal, longer in fruit 6–7 lines [12–15 mm] long. Petals about twice the length of the sepals, unequal, margins denticulate, rose-coloured when dry. Capsule a little larger than a peppercorn, glossy, smooth. Style longer than the stamens, bristle-like, curved apically, very shortly bifid or divided, both sides papillose-stigmatic on the inside, not thickened.”

Although it might at first seem that from these descriptions, and from the herbarium specimens that *B. gigantea* more closely resembles many specimens of the northern taxon, *B. lamellata* (Figure 3),

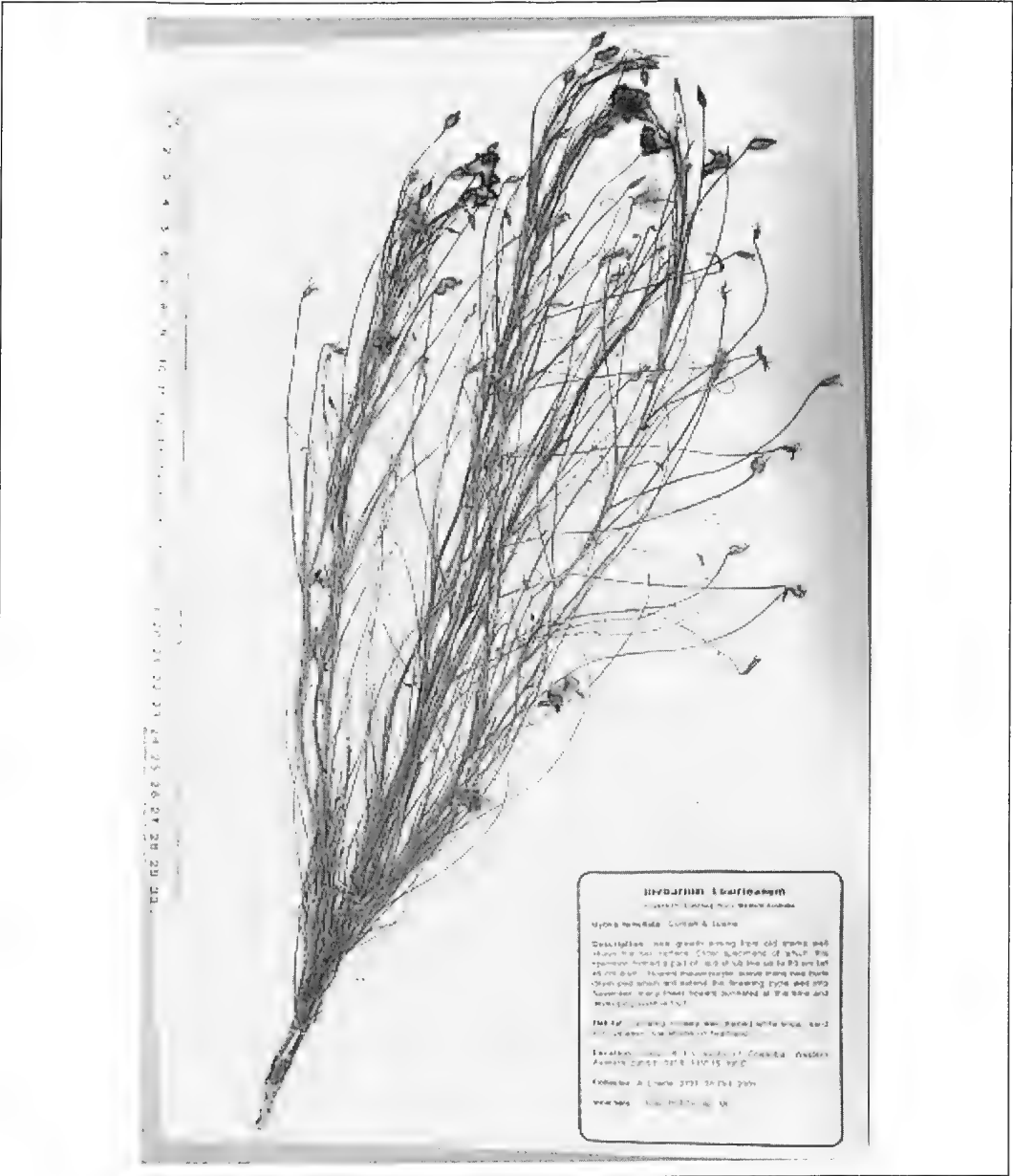


Figure 3. Holotype of *Byblis lamellata* Conran & Lowrie.

whereas *B. lindleyana* is like many of the plants encountered for the southern taxon, there are several reasons supporting the reduction of both names to synonymy and the recognition instead of a new name for the northern taxon. Although the specimens available to Planchon were very different in their stem elongation, field observation of both the northern and southern taxa confirms that they will undergo shoot elongation under crowding from other plants. As the southern species grows in generally more dense swamp vegetation, it is more common to find elongated plants of this taxon. The number of sepal nerves also varies in both *B. gigantea* and *B. lamellata* from 3 to 5.

More importantly, the collections cited by Planchon were Drummond collections from Lindley's herbarium and part of Herbarium Hookerianum. At the time that Planchon was working on this material, the only collections to which he had access were from the Drummond collections sent to Lindley in Nov. 1838 and Nov. 1839. All of these represented material collected from the Swan, Avon, Helena and Toodyay Valleys as well as the Guangan [Wongan Hills]. Drummond did not travel to the area where the northern taxon grows until 1852, when material from his sixth collection was sent to Hooker from the Murchison River and Champion Bay to Dandaragan Region (Erickson 1969). As all the Lindley collections were from plants in the southern taxon's range, and we now know that the habit can alter based on competition for light and space, it seems most likely that *B. gigantea* and *B. lindleyana* represent uncrowded and crowded plants respectively. Furthermore, examination of seeds on the type material for *B. lindleyana* confirm that they are part of the southern corrugately-ribbed taxon. Accordingly, the southern taxon represents *B. gigantea* and includes *B. lindleyana* as a synonym, whereas the northern taxon represents a new species.

Byblis lamellata* Conran & Lowrie, *sp. nov.

B. giganteae Lindl. affinis sed semina lamellata, non corrugata, inferne striata, et caule acrialis repullulans.

Typus: about 4 km south of Eneabba, Western Australia, 29°51'S, 115°16'E, 31 October 2001, A. Lowrie 2731 (*holo:* PERTH 05853834; *iso:* K, MEL).

Small branched woody *perennial sub-shrub* to c. 60 cm from a subterranean rhizome. *Leaves* linear to 20 cm long, lamina reniform in cross-section, marginally and abaxially glandular hairy. *Pedicels* to 15 cm long, glandular-hairy. *Sepals* lanceolate, 8–15 mm long, 2.5–3.5 mm wide basally, abaxially glandular-hairy. *Petals* 15–20 mm long, glabrous, lobes obovate, to 15 mm wide, apically serrate, pink to cerise-mauve, rarely white. *Stamens* 5, filaments 2.5–3.5 mm long; anthers 5–6 mm long, yellow with brown apices. *Ovary* subglobose, 1.5–2 mm long, \pm glabrous. *Style* 7–9 mm long, basally glandular. *Capsule* ovoid, 5–7 mm long, 3.5–4 mm wide. *Seeds* 1–1.8 mm long, with weakly longitudinally ribbed, lamellate plate-like ridges but lacking obvious transverse ridges or complex corrugate sculpturing. **Northern Sandplains Rainbow Plant** (Figures 2B, 3)

Selected specimens examined. WESTERN AUSTRALIA: 30 km N of Eneabba, 17 Sep. 1979, P. Armstrong 95 (PERTH); Western Titanium leases, 8 km S of Eneabba, 10 Sep. 1976, E.A. Griffin 524 (PERTH); 7.7 miles [12.3 km] NE of Eneabba on Three Springs road, 8 Oct. 1967, W.A. Loneragan 67018 (PERTH); 5 km S of Eneabba, 1 Oct. 1993, A. Lowrie 798B (PERTH); 5 km S of Eneabba, 16 Dec. 1996, A. Lowrie 1671 (PERTH); Arrowsmith River, E of Brand Highway, 16 Dec. 1996, A. Lowrie 1674 (PERTH); Mogumber, 2 Dec. 1965, F. Lullfitz 4465 (PERTH); 12 km W of Gingin–Dongara road, on road to Nambung National Park, 29 Nov. 1974, A.E. Orchard 4255 (PERTH); 16 miles [25.6 km] E of Green Head, Jan. 1968, K.R. Newbey 3144 (PERTH).

Distribution. *Byblis lamellata* is distributed on the northern sand plains from Arrowsmith River south to Cataby in south-west Western Australia (Geraldton Sandplains and Swan Coastal Plain Bioregions), although Erickson (1968) erroneously listed the Murchison River as the northern limit. (Figure 1)

Habitat. *Byblis lamellata* grows in open heathland on well drained white silica sands.

Flowering period. September to January.

Conservation status. *Byblis lamellata* is locally common in a number of areas within its range, several of which are in reserves. It is currently not threatened.

Etymology. The epithet *lamellata* is taken from the Latin *lamellus* – a plate, with reference to the plate-like processes on the seeds.

Affinities. The species is closely related to *B. gigantea*, but differs from it in seed morphology, lacking muricate sculpturing on the seed processes; resprouting response, by resprouting from aerial stem remnants as well as from the rhizome; habitat, growing in much drier environments; flowering time, tending to flower much earlier; and geography, being geographically disjunct from *B. gigantea* which grows some 100 km to the south.

Acknowledgements

The directors of PERTH and K are thanked for their assistance for access material, as is the ABLO for arranging photography of the type specimens and examining them for seed morphology. The Department of Environmental Biology, CEMMSA and Adelaide University are thanked for the provision of facilities to undertake part of this research.

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***Conostephium magnum* (Epacridaceae), a new species from Western Australia**

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Abstract

Cranfield, R.J. *Conostephium magnum* (Epacridaceae), a new species from Western Australia. *Nuytsia* 15(1): 21–25 (2002). A new species of Epacridaceae endemic to the South West Botanical Province of Western Australia, *Conostephium magnum* Cranfield, is described, illustrated and mapped. It is related to *C. minus* Lindl. and *C. pendulum* Benth.

Introduction

Conostephium Benth. (Epacridaceae), is a small genus endemic to the south-west of Western Australia. A specimen collected in 1995 during a field survey was identified as *Conostephium pendulum* Benth. but was considered not to be typical. Further field studies in 1996 confirmed the distinctiveness of the new taxon, as several characters separating it from *C. pendulum* were observed where both occurred at the same location. Detailed examination of PERTH herbarium specimens combined with field observations led to the conclusion that this taxon is a new species, which is described here.

Earlier determinations of collections of this new species placed it within the *Conostephium pendulum* complex and in some instances as a variant of *C. minus* Lindl., to which it keys out in Blackall & Grieve (1965). Descriptions of the two closely related species *C. minus* and *C. pendulum* are given in Wheeler (1987). Following recognition that the new taxon was a distinct species it was placed it under the informal name *Conostephium* sp. Badgingarra (*E.A. Griffin* 6814).

Taxonomy

Diagnostic characters for the three named species of the *Conostephium pendulum* complex are given in Table 1. *Conostephium magnum* tends to be a larger plant than both the other species listed. The short pedicels and hairy ovary of *C. magnum* separate it from *C. pendulum*. Although *C. minus* has a similar pedicel length and ovary indumentum to *C. magnum*, it is readily distinguished by its smaller leaves and flowers, especially by its shorter corolla lobes.

Table 1. Characters distinguishing the recognised species of the *Conostephium pendulum* complex.

Character	<i>C. magnum</i>	<i>C. pendulum</i>	<i>C. minus</i>
height (m)	0.4–2	0.15–1	0.15–0.75
leaf			
petiole length (mm)	1–1.7	0.5–3	0.5–1
blade length (mm)	11–28	10–38	4–15
width (mm)	2–4	3–8	2–3
flower			
pedicel length (mm)	1.5–3	3.5–10	1.5–3
flower length (mm)	11–14	5–16	8–9
flower width (mm)	3–4	3–5	2–3
corolla lobe length (mm)	1–2	0.5–1.5	0.2–0.5
ovary	hairy	glabrous	hairy

As it is presently delimited, *Conostephium pendulum* appears to include several atypical entities that relate to distribution patterns and ecological factors. Consequently the measurements presented for this taxon in Table 1 encompass a wide variation, often much greater than the variation in the other two species. More study of *C. pendulum sens. lat.* is needed to resolve the problems remaining in this species complex.

Despite their overlapping distributions and similar habitats, *Conostephium magnum* and *C. minus* are not known to coexist at any localities. *C. pendulum* does coexist with *C. magnum* at a few localities but no intermediates have been observed. The flowering times of these three species are similar, with *C. pendulum* flowering from early March to October, *C. magnum* in July–September and *C. minus* in August–October. Despite this overlap, the peak flowering time for each of the three species appears to be different, with *Conostephium pendulum* peaking in June, *C. magnum* in August and *C. minus* in September.

Conostephium magnum* Cranfield, *sp. nov.

Conostephium penduli et *C. minori* affinis; differt a priore ovario hispidulo, a posteriore statura altiore et foliis majoribus.

Typus: c. 3.5 km north of road into Tiwest Cooljarloo mine site, west of Brand Highway, 30°37'S, 115°27'E, Western Australia, 14 September 1993, S. J. Patrick 1566 (*holo:* PERTH 03553558; *iso:* CANB).

Shrub 0.4–2 m high; branchlets clustered at ends of branches. *Leaves* alternate, scattered, erect, glabrous; petiole 1–1.7 x 0.4–0.6 mm; lamina oblanceolate, often inrolled, 11–28 x 2–4 mm, concolorous, with numerous prominent veins on abaxial surface, apex acute to obtuse. *Inflorescence* of solitary axillary flowers on previous year's regrowth. *Pedicels* pendulous, 1.5–3 mm long, hispid, with a series of bracts and bracteoles grading into the sepals, the uppermost part shed with the flower; bracts 4–6, occurring below the abscission point, sessile, imbricate, ovate, apex obtuse, the basal ones 0.5–0.6 mm long and fringed, the 2 upper ones up to 2 mm long and ciliate. *Bracteoles* 3–5, above the

abscission point, sessile, imbricate, narrowly ovate, 6–8 x c. 3 mm, cream to white with a pink apex, ciliate. *Sepals* 3–5, imbricate, narrowly ovate, 7–9 x 2.5–3.5 mm, white to cream, apex obtuse, glabrous. *Corolla* usually pink to purple, sometimes white; tube narrowly urceolate, 12–13 x 2–2.5 mm, glabrous to hirsute; lobes 5, erect to spreading, linear, 1–2 mm long, acute. *Stamens* 5, enclosed in corolla tube, attached in the middle; anther narrowly triangular, 1–1.5 x 0.25–0.5 mm. *Ovary* ovoid, lobed, c. 1.5 x 1.5 mm, hispid on the upper 1/3, 5-locular; ovules ellipsoid, c. 0.25 mm long. *Style* 12–14 mm long, kinked above the ovary. *Fruit* globose, c. 6 x 5 mm, hispid on the upper part; seeds not seen. (Figure 1).

Selected specimens examined. WESTERN AUSTRALIA: 11.2 km S of Eneabba turn off Brand Highway, 29 Aug. 1985, *M.E. Ballingall* 1964 (PERTH); Conservation Park 41986 on Brand Highway, N of Cataby, 27 Nov. 1996, *E. Bennett & D. Woodman* 271102 (PERTH); 6.5 km S of Eneabba, 31 Aug. 1993, *R.J. Cranfield & D. Kabay* 8815 (PERTH); 6.5 km W of Brand Highway, Jurien Bay turn off, 2 July 1992, *R.J. Cranfield & P.J. Spencer* 8290 (PERTH); 2 km E of Catamouri Hill, 18 June 1996, *R. Davis* 1359 (PERTH); W margin of Badgingarra National Park on Biddy Creek Rd, 14 Oct. 1978, *J. Dodd* 24 (PERTH); Briera Rd, S of Gingin, 7 Aug. 1970, *A.S. George* 10115 (PERTH); intersection of Brand Highway and Waddi Rd, S of Badgingarra, 28 Sep. 1992, *E.A. Griffin* 6813 (PERTH); 17.8 km N of intersection of Brand Highway and Coorow–Greenhead road, 9 Sep. 1985, *N. Hoyle* 105 (PERTH); 10.6 km N of Cataby Road House, 10 Sep. 1981, *R. Spjut & C. Edson* 7036 (PERTH).

Distribution. Extends from Eneabba south to Cataby, with an isolated record further south near Gingin, in the Irwin Botanical District of the South West Botanical Province of Western Australia. (Figure 2)

Habitat. Open woodland over white to grey sand sometimes associated with lateritic gravels.

Flowering period. July to September.

Conservation status. Not known to be under any immediate threat but, due to its restricted occurrence, may be worth monitoring.

Etymology. The specific epithet is from the Latin word *magnum* for large, referring to the height of this species.

Notes. The degree of leaf inrolling, originally thought to be a stress factor, appears to occur in varying degrees independently of any obvious influences. This inrolling is part of the general facies of *Conostephium magnum*, and is one of the characters by which the species can be recognised. However on its own it is insufficient to identify *C. magnum*, so it is unreliable as a field character. Where both *C. magnum* and *C. pendulum* occur in the same locality, the former can normally be distinguished by the greater height of mature plants, while juvenile plants of the latter are distinguished by their wider and shorter leaves.

The separation of sepals from bracteoles in *Conostephium* species is often difficult to determine as they appear to form a continuous sequence and both are coloured. Perhaps the best distinction between them in *C. magnum* is that the bracteoles have ciliate margins and the sepals are glabrous. The outer bracteoles can also be distinguished by having the apex highly coloured, although this feature may not be so obvious in the inner bracteoles. There is some difference in size between the outer and inner bracteoles with the latter almost as large as the sepals (Figure 1E).

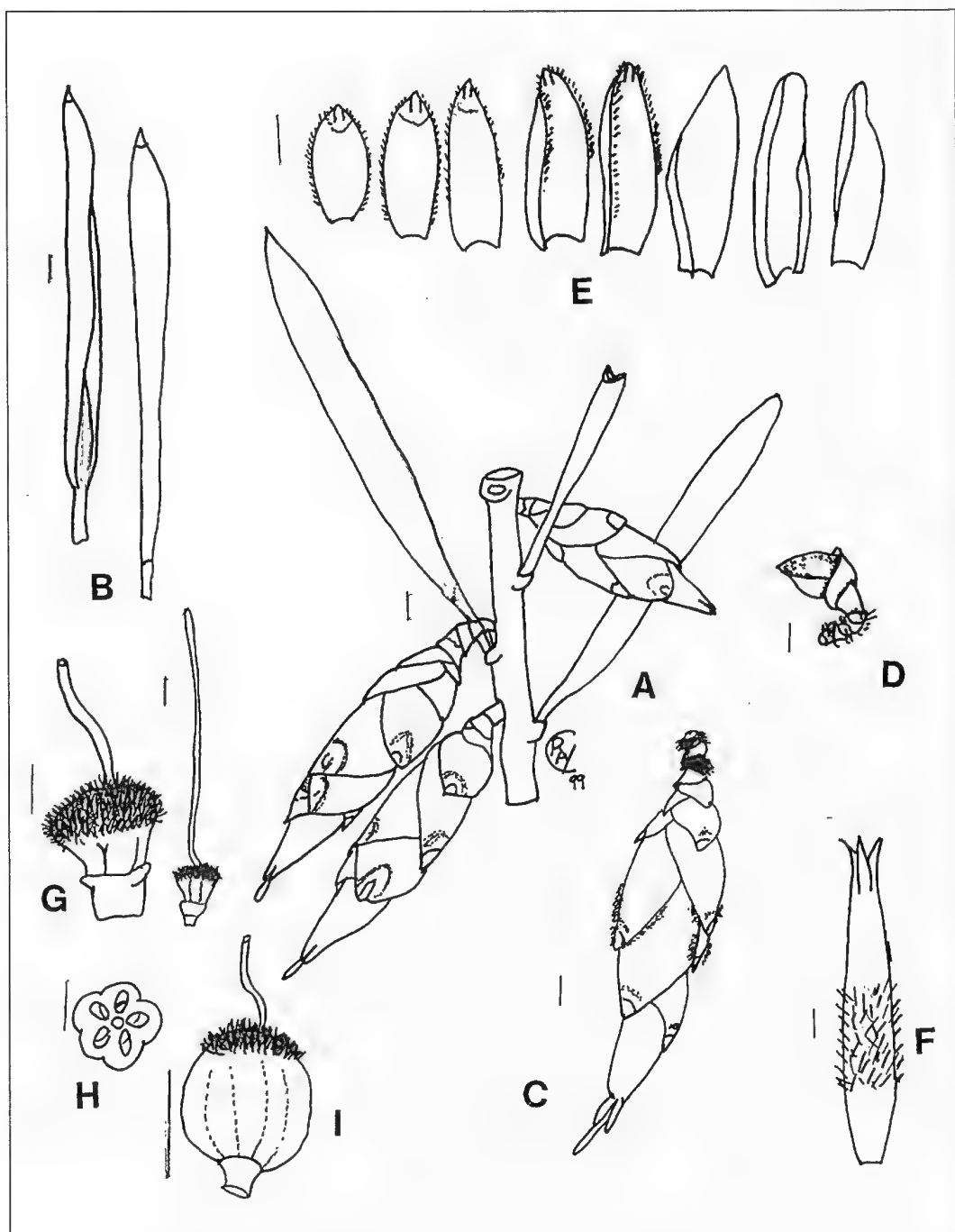


Figure 1. *Conostephium magnum*, scale bars = 1 mm. A – portion of flowering stem, B – two views of leaf, C – flower and subtending bracts, D – pedicel and bracts after flower shed, E – bracteoles and sepals, F – corolla, G – gynoecium (with basal part enlarged), H – TS of ovary, I – fruit.

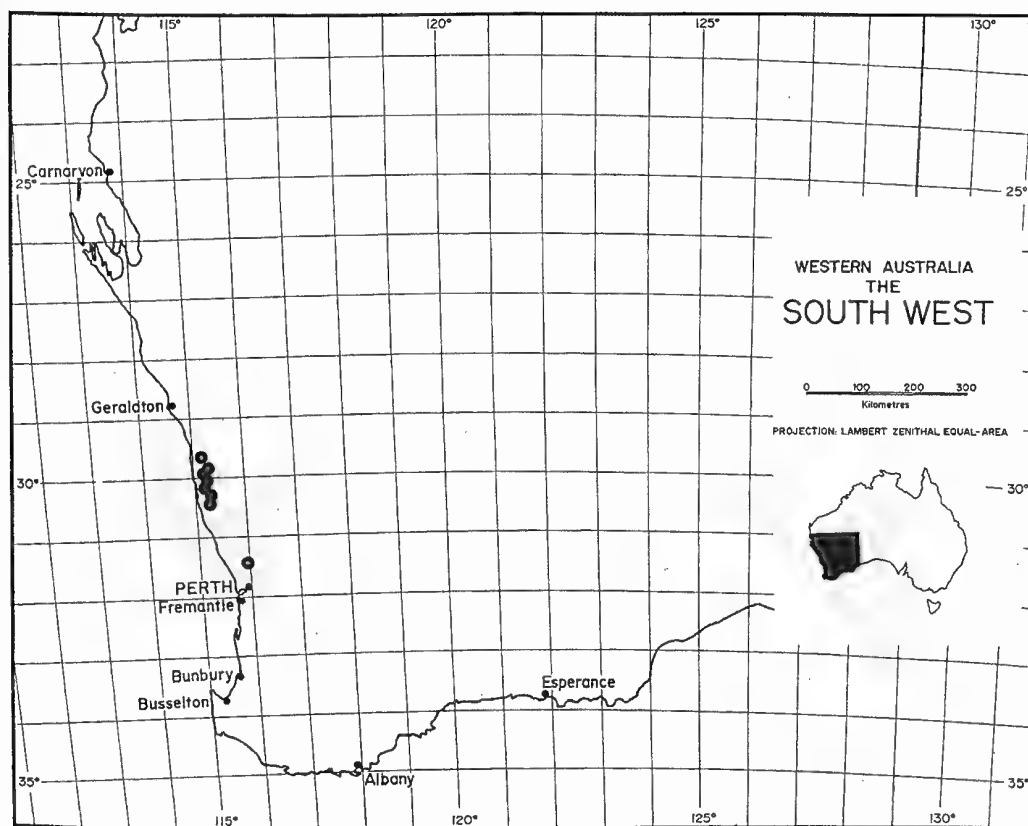


Figure 2. Distribution of *Conostephium magnum*.

The bracts show a clearer differentiation in size, with those lowest on the pedicel c. 0.5 mm long and the two just below the abscission point usually 1–2 mm in length. A natural abscission point was noted on the old pedicels, and Figure 1D shows the bracts occurring below this point. The remaining bracts, i.e. those above the abscission point, are all referred to here as bracteoles, although they intergrade with the bracts below.

Acknowledgements

The Latin description was kindly prepared by Paul G. Wilson. Terry Macfarlane and Barbara Rye are thanked for their advice and comments while this paper was in preparation.

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A comparison of the leaf anatomy of *Ficus subpuberula*, *F. atricha* and *F. brachypoda* (Moraceae)

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Abstract

Dixon, D.J. A comparison of the leaf anatomy of *Ficus subpuberula*, *F. atricha* and *F. brachypoda* (Moraceae). *Nuytsia* 15(1): 27–32 (2002). The leaf anatomy of *Ficus subpuberula* Corner, *F. atricha* D.J.Dixon, and *F. brachypoda* (Miq.) Miq. are compared in order to facilitate identification of these partly sympatric species. *Ficus subpuberula* was found to possess distinctly thinner ($267.6 \pm 4.3 \mu\text{m}$), isobilateral leaves compared to the much thicker ($313.3 \pm 12.1 \mu\text{m}$ and $425.6 \pm 17.8 \mu\text{m}$), dorsiventral leaves of *F. atricha* and *F. brachypoda* respectively. Tanniniferous cells were present in *F. atricha* and *F. brachypoda*, but absent in *F. subpuberula*. The upper epidermis and the palisade parenchyma of *F. brachypoda* were about twice as thick as in *F. atricha*.

Introduction

The affinity of *Ficus subpuberula* Corner to *Ficus platypoda* sensu Chew (1989) (*Urostigma* sect. *Malvanthera*) has long been debated. Chew (1989) considered *F. subpuberula* to be closely related to *F. platypoda* commenting that it may be a variant with thicker, more rigid leaves. In contrast, Wheeler (1992) described *F. subpuberula* as a species with thinly coriaceous leaves. Dixon (2001) defined the discontinuities between the taxa associated with the “*F. platypoda*” complex and recognised the following taxa: *F. brachypoda* and *F. atricha*. The application of types to these taxa, discussed in Dixon (2001), revealed that the name *F. platypoda* did not apply to these taxa but actually applied to the species previously known as *F. leucotricha*. Further, the two names synonymous with *F. brachypoda* viz., *F. platypoda* var. *minor* Benth. and *F. platypoda* var. *lachnocaulos* (Miq.) Benth., are the taxa previously confused with *F. subpuberula* with respect to leaf texture.

Although, morphologically, *Ficus subpuberula* can be distinguished from *F. brachypoda* and *F. atricha* by a suite of characters when reproductive material is present (Dixon, in press), the potential for confusion remains as all three species have a sympatric distribution for part of their range and vegetative material is often difficult to identify. In habitat, *F. subpuberula* is a spindly upright lithophyte with pendulous blue-green foliage. The leaves of *F. subpuberula* can either be glabrous or (minutely) pilose, but never with ferruginous hairs as found in *F. brachypoda*. *Ficus atricha*, as the name suggests, is completely glabrous in all its parts. A previous study on the anatomy of *Ficus* leaves by van Greuning *et al.* (1984) revealed that anatomical characters have been useful for identification purposes. In this

study of 24 African *Ficus* species van Greuning *et al.* (1984) found that, the number of epidermal layers, the structure of the spongy parenchyma, and the ratio of palisade parenchyma to the spongy parenchyma were all important in the delimitation of taxa. The aim of this research was to compare the leaf anatomy of *F. subpuberula*, *F. brachypoda*, and *F. atricha* to further substantiate the differences between the three taxa.

Methods

Sample preparation

Six individuals of *F. subpuberula* and *F. brachypoda* and five individuals of *F. atricha* were selected to represent the species across their respective distributional ranges (Appendix 1).

Fresh leaf material was fixed in FAA and then transferred to 70% ethanol. Samples from herbarium material were rehydrated in 70% ethanol. The central portion of the lamina including the midvein was then excised, dehydrated through a series of graded baths up to 100% ethanol, and infiltrated with paraffin wax. The samples were then imbedded in paraffin and sectioned at 5 and 10 micrometres on a rotary microtome. Haupt's adhesive was used to attach the sections to the microscope slides which were then dried overnight in a 60°C oven. Each section was stained in Alcian Blue and Safranin and permanently mounted in DPX. The slides have been lodged with DNA.

Section evaluation

Measurements of the total leaf thickness, width of the upper and lower cuticle, the upper and lower epidermis, the hypodermis, and the palisade parenchyma, were made at three sites along the section for each individual examined. Measurements were made adjacent to the midvein, at the central portion of the lamina, and just inside the margin of the leaf.

Eighteen measurements for each tissue type were made on *F. subpuberula* and *F. brachypoda*, and 15 measurements on *F. atricha*.

Results

The leaf anatomy of *F. subpuberula*, *F. atricha* and *F. brachypoda* is described below and the relevant statistical data are summarised in Table 1.

Ficus subpuberula (Figures 1A & B)

- upper (B) and lower epidermis of small unevenly sized parenchyma cells
- hypodermis of large uniformly sized parenchyma cells (B).
- upper palisade parenchyma of two to three layers, the third layer becoming indistinct (A).
- lower palisade parenchyma of one to two layers, may be undeveloped in places, leaf isobilateral (A).
- taniferous cells absent.
- midvein often surrounded by a one to four layered fibre sheath (not shown).

Table 1. Comparison of leaf anatomy summary statistics in *Ficus subpuberula*, *F. atricha* and *F. brachypoda*.

Character (thickness)	Summary statistics		
	<i>F. subpuberula</i>	<i>F. atricha</i>	<i>F. brachypoda</i>
upper cuticle	2.8 ± 0.1 µm	3.7 ± 0.4 µm	4.8 ± 0.7 µm
upper epidermis	6.2 ± 0.5 µm	6.8 ± 0.7 µm	11.5 ± 1.6 µm
hypodermis	49.3 ± 3.1 µm	73.1 ± 2.6 µm	86.7 ± 6.0 µm
palisade parenchyma	60.6 ± 4.0 µm	76.6 ± 7.3 µm	143.0 ± 10.5 µm
lower epidermis	27.7 ± 1.5 µm	32.8 ± 1.6 µm	50.5 ± 4.3 µm
lower cuticle	3.8 ± 0.3 µm	4.0 ± 0.4 µm	5.3 ± 0.9 µm
leaf total thickness	267.6 ± 14.3 µm	313.3 ± 12.1 µm	425.6 ± 17.8 µm

Ficus atricha (Figure 1C & D)

- upper (D) and lower epidermis of small elongated evenly sized parenchyma cells in two layers.
- hypodermis of larger unevenly sized parenchyma cells (D).
- upper palisade parenchyma of one to two layers, leaf dorsiventral (C), some lower palisade parenchyma cells but never as well developed as in *F. subpuberula* (A).
- taniferous cells interspersed with the palisade parenchyma (D).
- mid vein surrounded by a one to four layered fibre sheath (not shown).

Ficus brachypoda (Figure 1E & F)

- upper epidermis of small elongated evenly sized parenchyma cells (F).
- hypodermis of larger rounded to elongated irregular parenchyma cells (F).
- lower epidermis of irregularly sized parenchyma cells.
- palisade parenchyma cells of irregular length sometimes up to five layers, mostly of two layers, leaf dorsiventral (E), lower palisade parenchyma absent.
- taniferous cells interspersed with the palisade parenchyma (F).
- midvein surrounded by a one to three layered fibre sheath (not shown).

Discussion

Leaf anatomical differences has proved reliable in the delimitation of the three taxa investigated in this study. The leaves of *F. subpuberula* are isobilateral unlike those of *F. atricha* and *F. brachypoda* which are dorsiventral. *Ficus subpuberula* has long slender petioles that allow the leaves to ‘weep’ or hang. This habit may account for the isobilateral development of the palisade parenchyma. The results also show that *F. subpuberula* has much thinner leaves than both *F. atricha* and *F. brachypoda* (Table 1) supporting Wheeler’s (1992) assertion that *F. subpuberula* has thinly coriaceous leaves. The thicker leaves of both *F. brachypoda* and *F. atricha* can be rigid to such a degree that fresh material will snap if bent too far. However, when *F. atricha* is found in the more mesic areas of its distribution, the leaves can become more coriaceous. *Ficus brachypoda* has a wide distributional range, and specimens

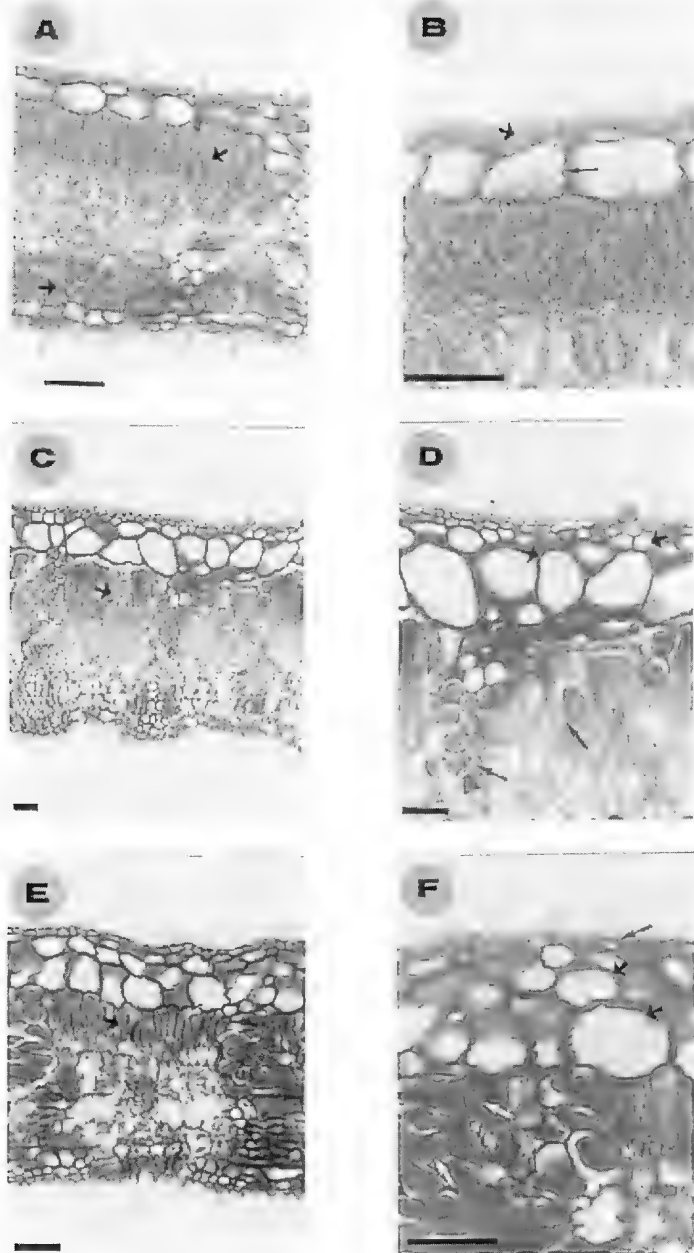


Figure 1. The light micrographs of the leaf transverse sections. Scale bars in each case equal 50 μ m. A – the isobilateral leaf of *Ficus subpuberula* with the development of adaxial and abaxial palisade parenchyma (black arrows); B – the upper epidermis of unevenly sized cells (short black arrow), and the hypodermis of larger uniformly sized cells (long black arrow) of *Ficus subpuberula*; C – the dorsiventral leaf of *F. atricha* with the development of adaxial palisade parenchyma only (black arrow); D – the upper epidermis of evenly sized cells (white arrow), the hypodermis of larger unevenly sized cells (short black arrows), and the taniferous cells (long black arrows) dispersed throughout the palisade parenchyma of *Ficus atricha*; E – the dorsiventral leaf of *F. brachypoda* with the development of adaxial palisade parenchyma only (black arrow); F – the upper epidermis of evenly sized cells (long black arrow), the hypodermis of larger unevenly sized cells (short black arrows), and the taniferous cells (white arrows) dispersed throughout the palisade parenchyma of *Ficus brachypoda*.

collected from central Australia have leaves that are much narrower and quite rigid compared to specimens from northern Australia. *Ficus brachypoda* and *F. atricha* also differ from *F. subpuberula* by the presence of taniniferous cells distributed throughout the palisade parenchyma. These cells may also contribute to the rigid nature of the leaves. Each species has a distinct multilayered epidermis and a hypodermis which is in contrast to the single layered epidermis reported by van Greuning (1984) for African species in the *Ficus* subgen. *Urostigma*.

The anatomical characters revealed in this study, together with the morphological characters described for *F. brachypoda* and *F. atricha* in Dixon (2001), provide compelling data supporting the distinctiveness of *F. subpuberula*, *F. brachypoda* and *F. atricha*. *Ficus subpuberula* can be differentiated on the presence of adaxial and abaxial palisade parenchyma and the absence of taniniferous cells. The leaves of *F. atricha* and *F. brachypoda* are comparatively similar having only one adaxial layer of palisade parenchyma but differ in thickness. The greatest differences between these two species were in the upper epidermis and palisade parenchyma, both of which were about twice as thick in *F. brachypoda* as in *F. atricha*. With the addition of morphological characters *F. atricha* and *F. brachypoda* are easily separated. *Ficus atricha* is the only species in the *Urostigma* sect. *Malvanthera* to be completely glabrous in all its parts. In comparison *F. brachypoda* has a combination of hyaline and ferruginous hairs present on all its parts. Hyaline hairs are sometimes found on the leaves of *F. subpuberula*; however, it is more common for the leaves of this species to be minutely pubescent, that is, almost pubescent. Ferruginous hairs are never found on *F. subpuberula*.

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Appendix

The collection details for the specimens used in the anatomical study. Herbarium acronym where specimen is held is indicated in parentheses.

Ficus atricha: King Creek Gorge, 15 km SW of Bedford Downs Homestead, 65 km W of Great Northern Highway, 102 km NNW of Halls Creek, Kimberley, 23 June 1976, *A.C. Beauglehole* ACB53670 (PERTH); c. 40 km SSW of Nathan River Homestead, 15°56'S, 135°20'E, 27 Aug. 1985, *P.K. Latz* 10108 (DNA); c. 3 km E of Gallen Well on Catamaran Bay, Dampierland Peninsula, 16°31'S, 122°59'E, 20 Aug. 1985, *K.F. Kenneally* 9463 (PERTH); Boomerang Bay, W side of Bigge Island, Bonaparte Archipelago, W Kimberley coast, 14°33'S, 125°09'E, 28 May 87, *K.F. Kenneally* 10014 (PERTH); Brunswick 8.7 km NE of Cape Brewster on unnamed island, site 2, 15°03'S, 124°57'E, 12 June 1987, *K.F. Kenneally & B.P.M. Hyland* 10365 (PERTH).

Ficus brachypoda: Kununurra, off road N of Hidden Valley Caravan Park, 15°43'S, 128°44'E, 21 Oct. 1997, *D. Dixon* PHD444 & *I. Champion* (DNA, JCT); off Great Northern Highway, 95.5 km NE of Fitzroy Crossing, 18°44'S, 126°05'E, 25 Oct. 1997, *D. Dixon* PHD457 & *I. Champion* (DNA, JCT); off Great Northern Highway, 92 km NE of Fitzroy Crossing, 18°45'S, 126°04'E, 25 Oct. 1997, *D. Dixon* PHD459 & *I. Champion* (DNA, JCT); Victoria Highway, 100 km E of Kununurra, 16°00'S, 129°29'E, 27 Oct. 1997, *D. Dixon* PHD460 & *I. Champion* (DNA, JCT); Ross Highway E of Alice Springs, Mt Benstead Creek crossing, 23°35'S, 134°26'E, 5 Nov. 1997, *D. Dixon* PHD485 & *I. Champion* (DNA, JCT); Ross Highway E, of Alice Springs, Mt Benstead Creek crossing, 23°35'S, 134°26'E, 5 Nov. 1997, *D. Dixon* PHD486 & *I. Champion* (DNA, JCT).

Ficus subpuberula: Edith Falls, 16 Oct. 1997, *D.J. Dixon* PHD419 & *I. Champion* (DNA, JCT); Edith Falls, 16 Oct. 1997, *D.J. Dixon* PHD418 & *I. Champion* (DNA, JCT); 13 km W of Kununurra off highway on track to Blackrock waterhole, 15°39'S, 128°39'E, 20 Oct. 1997, *D.J. Dixon* PHD442 & *I. Champion* (DNA, JCT); Cannon Hill, 12°22'S, 132°57'E, 17 July 1975, *M. Parker* 650 (DNA); Edith Falls Reserve, 14°12'S, 132°11'E, 5 Oct. 1977, *M.O. Parker* 1123 (DNA); 2 km N of Nabarlek Airstrip, 12°17'S, 133°19'E, 26 Apr. 1979, *M.O. Rankin* 2187 (DNA, MEL).

A new species of *Blennospora* (Asteraceae: Gnaphalieae)
from the Swan and Scott Coastal Plains of Western Australia

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Abstract

Keighery, G.J. A new species of *Blennospora* (Asteraceae: Gnaphalieae) from the Swan and Scott Coastal Plains. *Nuytsia* 15 (1): 33–36 (2002). A new species of *Blennospora* A. Gray, *B. doliiformis* Keighery, is described from the Swan and Scott Coastal Plains. The species occurs on clay soils in fresh winter-wet sites. A key is given to the three species now recognised in the genus.

Introduction

During intensive floristic and reserve surveys of the Swan Coastal Plain (Gibson *et. al.* 1994) it became apparent that several taxa present in the area required taxonomic study. One of these is a new species of *Blennospora* A.Gray, which is described here. This is the sixth in a series of papers (Keighery 1997, 1998, 2001a–c) describing new taxa from the Swan Coastal Plain.

Blennospora is a southern Australian genus in the subtribe Angianthinae Benth. (Asteraceae: Gnaphalieae). It was revised by Short (1987) who recognised two species, *B. drummondii* A. Gray, occurring in Western Australia, South Australia and Victoria, and *B. phlegmatocarpa* (Diels) P.S. Short, confined to the wheatbelt of Western Australia. From his distribution maps it is apparent that at the time of his studies there were no collections of the genus from the Swan or Scott Coastal Plains. The earliest collection from these areas dates from late 1987 (G.J. Keighery 9274).

Taxonomy

Key to species in the genus *Blennospora*

- 1. Corolla lobes purplish-black **B. drummondii**
- 1. Corolla lobes yellow
 - 2. Involucral bracts inconspicuous, inflorescence ellipsoid-ovoid **B. phlegmatocarpa**
 - 2. Involucral bracts conspicuous, inflorescence barrel-shaped **B. doliiformis**

Blennospora doliiformis Keighery, *sp. nov.*

A Blennospora drummondii A.Gray caule erecto gracile, floribus aureis, inflorescentia doliiformi; bracteis prominentibus differt.

Typus: Ruabon Nature Reserve, 33°39'S, 115°30'E, Western Australia, 3 November 1993, *G.J. Keighery* 12931 (*holo:* PERTH 00363369).

Annual herbs 5–15 cm high. *Major axis* erect, cottony-hairy but becoming glabrous and brown in basal 4 cm, stem usually simple, with 1 or 2 major branches at upper nodes. *Leaves* erect, semi-terete to terete, linear, often soft and more or less succulent, 5–15 mm long, c. 0.1 mm wide, mucronate, cottony-hairy, the uppermost leaves with hyaline apex and margins, never overtopping the inflorescence. *Inflorescence* barrel-shaped (urceolate to narrowly turbinate), flat at summit, 6–9 mm long, 4–6 mm wide. *Involucral bracts* conspicuous, pale brown, scarious, in 2 rows, obovate to oblanceolate, apex acute, margins entire, base densely hairy; outermost ones 4–6 mm long, 3–4 mm wide; inner ones 5–7 mm long, 4–5 mm wide. *Capitular bracts* in 2 or 3 rows; outer ones obovate-elliptic, 1.5–3 mm long, 0.5–1 mm wide, hyaline with a pale brown midrib, flat to conduplicate, margins roughly divided, glabrous internally but with long hairs at the base and uniting the bracts; inner ones elliptic to obovate, 2–4 mm long, 1.5–3 mm wide, hyaline margins entire or jagged, glabrous on the inner surface, base with long hairs uniting the bracts. *Florets* 1–3 per capitulum. *Corolla* with a tube 1.8–2.4 mm long; lobes 4 or 5, golden yellow. *Stamens* 5; anther 0.5–0.8 mm long. *Cypselas* brown, obovoid, 1–1.5 mm long, c. 1 mm diam. *Pappus* of 7 or 8 bristles, more or less equal to length of corolla tube. (Figure 1A,B)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: 2 km SE of Ruabon on Wonnerup Rd, 33°39'S, 115°32'E, 9 Nov. 1987, *G.J. Keighery* 9274; Yoongarrillup Town Reserve, 33°43'S, 115°26'E, 14 Oct. 1992, *B.J. Keighery & N. Gibson* 005; Fish Road Nature Reserve, 33°44'S, 115°23'E, 14 Oct. 1992, *B.J. Keighery & N. Gibson* 006; Fish Road Nature Reserve, 33°44'S, 115°23'E, 14 Oct. 1992, *B.J. Keighery & N. Gibson* 010; Lake Muckenburra Reserve No. 25431, 31°21'S, 115°47'E, 27 Oct. 1993, *B.J. Keighery & N. Gibson* 026; Austin Bay Nature Reserve, 32°37'S, 115°47'E, 29 Oct. 1993, *B.J. Keighery & N. Gibson* 020 & 021; Ruabon Nature Reserve, 33°39'S, 115°31'E, 8 Nov. 1992, *B.J. Keighery & N. Gibson* 010; Scott National Park, 34°17'S, 115°15'E, 1 Nov. 1990, *C.J. Robinson* 300.

Distribution. Recorded from Gingin to Busselton on the Swan Coastal Plain, then disjunct to the Scott Coastal Plain.

Habitat. Occurs on seasonally wet clay soils either grey or red clay over ironstone under *Melaleuca cuticularis* low woodland, *Melaleuca uncinata*/*M. viminea* shrubland, *Dryandra squarrosa* shrubland or lateritic heath.

Flowering period. Flowering in late spring, from October to November. Mature Fruits and seeds are found in late December to January. Seeds are held in the inflorescence on the dried dead plants until the rains of the following winter.

Conservation status. Conservation Codes for the Western Australian Flora: Priority Three. On the Swan Coastal Plain this species has been recorded from five actual or proposed reserves (Keighery 1999).

Etymology. The specific name *doliiformis*, from the Latin for barrel-shaped, refers to the inflorescence of this species.

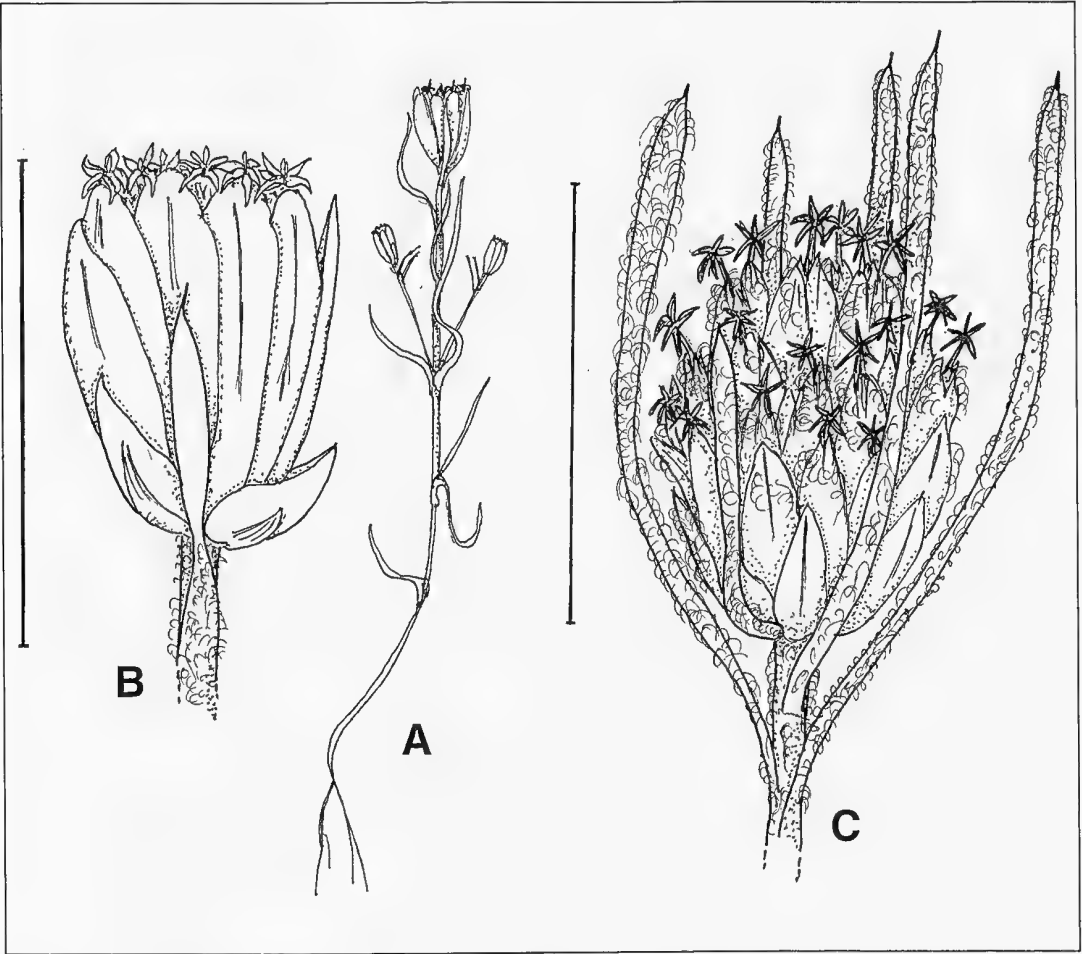


Figure 1. A, B – *Blennospora doliiformis*, drawn from G.J. Keighery 9274 (PERTH). A – whole plant; B – inflorescence (scale bar = 10 mm); C – *Blennospora drummondii*, inflorescence (scale bar = 10 mm), drawn from G.J. Keighery & N. Gibson 2888 (PERTH).

Notes. Previously known by the informal name *Blennospora* sp. Ruabon (B.J. Keighery & N. Gibson 20). It differs from *Blennospora drummondii* in the shorter narrower leaves, flat-topped barrel shaped inflorescence compared to ellipsoid to broadly ellipsoid or ovoid to broadly ovoid (see Figure 1C), in having conspicuous inflorescence bracts, in the leaves not overtopping the inflorescence, and the flowers not aging brown. Plants are normally single-stemmed and do not branch near the base as is frequently the case in *B. drummondii*.

Acknowledgements

The author was able to view type material, and other collections at MEL with the assistance of the curator of Melbourne Herbarium, Jim Ross. Thanks are also due to the other bodies (Environment Australia and the Australian Heritage Commission) who funded the biological surveys noted herein.

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A review of the genus *Pileanthus* (Myraceae)

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Abstract

G.J. Keighery. A review of the genus *Pileanthus* (Myrtaceae). *Nuytsia* 15(1): 37–51 (2002). *Pileanthus* Labill., a small genus of floriferous shrubs endemic to southern Western Australia, is reviewed. Eight species are recognised, one of which has two subspecies. Four new species (*Pileanthus auranticus* Keighery, *P. bellus* Keighery, *P. rubronitidus* Keighery and *P. septentrionalis* Keighery) and one new subspecies (*P. peduncularis* subsp. *piliferus* Keighery) are described, and *P. vernicosus* F. Muell. is reinstated.

Introduction

Pileanthus is a small genus of floriferous shrubs endemic to southern Western Australia. Four species had been described prior to Bentham's (1867) treatment of the genus in "Flora Australiensis", but Bentham reduced one of these, *P. vernicosus*, to synonymy. Kuntze (1903) divided the genus into two sections, sect. *Pileanthus* [as *Eupileanthus* nom. illeg.] with stamens divided (now comprising *P. limacis*, *P. septentrionalis*, *P. filifolius* and *P. vernicosus*) and sect. *Monopileanthus* with the stamens undivided (now comprising *P. auranticus*, *P. bellus*, *P. rubronitidus* and *P. peduncularis*). These sections are perhaps essentially different pollination syndromes and are comprised of species from very different species complexes that are probably not closely related.

Recent studies of the genus, partly in collaboration with N.G. Marchant, have demonstrated the need to reinstate *P. vernicosus* and have resulted in four new species and a new subspecies being recognised. This paper provides concise descriptions, illustrations, distribution maps and a key for the eight species now recognised in the genus.

Pileanthus is a very distinctive member of the *Chamelaucium* alliance (Briggs & Johnson 1979, Johnson & Briggs 1985) and is closely related to *Chamelaucium* Desf., *Darwinia* Rudge and *Verticordia* DC. It differs from those genera in having 20 perfect stamens and no staminodia, the sepals deeply bilobed giving the appearance of 10 calyx segments, a silky hairy hypanthium and large soft petals. The genus has the largest and most colourful flowers of the genera that make up the *Chamelaucium* alliance, and populations are spectacular when in full flower.

Materials and methods

Herbarium collections from PERTH and most major Australian herbaria were examined during the course of the study. Type collections and/or photographs of type collections were examined from relevant herbaria. All measurements were taken from dry pressed material supplemented by observations of living plants in the field and cultivation.

The conservation codes given in this paper are those used by the Department of Conservation and Land Management. An explanation of these codes is given in each issue of *Nuytsia*.

Taxonomic treatment

Pileanthus Labill., Nov. Holl. Pl. Sp. 2, 11, t. 149 (Feb. 1801). – *Pileanthus* Labill. sect. *Pileanthus* [as sect. *Eupileanthus* *nom. illeg.* in T. von Post & O. Kuntze, Lex. Gen. Phan. 438 (Dec. 1903)]. *Type*: *Pileanthus limacis* Labill.

Pileanthus sect. *Monopileanthus* Kuntze in T. von Post & O. Kuntze, Lex. Gen. Phan. 438 (Dec. 1903). *Type*: *Pileanthus peduncularis* Endl.

Shrubs to 3 m tall. *Branchlets* terete, brown, with oil glands epidermis becoming grey and shedding, with persistent stipular outgrowths often present in the leaf axils. *Leaves* opposite and decussate, sometimes in dense opposite clusters, sessile, linear to clavate, with prominent oil glands, margins entire to laciniate. *Floral leaves* similar to vegetative ones except in *P. limacis*. *Inflorescence* of solitary flowers in upper axils. *Bracteoles* 2, opposite, united at base into a cup, enclosing the bud, scarious, usually prominently umbonate, often viscid with a white oily exudate, free portions above the cup caducous; cup turbinate, around the hypanthium. *Flowers* regular, bisexual, large. *Hypanthium* campanulate, pilose outside, adnate to ovary for most of its length. *Sepals* 5, erect to spreading, deeply bilobed giving the appearance of separate lobes, usually sparsely pilose. *Petals* 5, soft, exceeding the calyx, often brightly coloured, margins usually shortly dentate. *Androecium* of 20 stamens in a single row, with one stamen opposite each sepal and petal and the rest alternating between the sepals and petals, united at the base, antipetaline stamens often distinctly longer than antisepaline ones, the anthers sometimes also distinctly different in size; free filaments slender but dilated at the base; anther cells parallel, opening longitudinally, either attached contiguous to the thickened end of the filament or separately attached to the branches of a forked filament. *Ovary* 1-celled, with 4 or 8 ovules in 2 rows on an erect free basal placenta. *Style* simple, filiform, terete; stigma small, terminal. *Fruit* usually a 1-seeded nut formed from the hardened base of the hypanthium, dispersed as a unit with the dried upper hypanthium and sepals attached.

Chromosome number. $n = 11$ has been recorded for four species. There are no records of polyploidy or dysploidy in the genus (Rye 1979).

Distribution and habitat. The genus *Pileanthus* consists of eight species endemic to southern Western Australia. Members are found on sandy soils in the Avon Wheatbelt and Geraldton Sandplain Biogeographic regions of south Western Australia and extend into the adjacent Carnarvon Biogeographic region of arid Western Australia. There is a concentration of species on the northern margins of the Geraldton Sandplains. This is a very different pattern to that shown by the related genera *Chamelaucium*

and *Darwinia* which are species-diverse on the Mt Lesueur area of the southern Geraldton Sandplains and on the Esperance Sandplains with minor centres in the Avon Wheatbelt.

Etymology. From the Greek, *pileos* – cap and *anthos* – flowers, referring to the close fitting bracteoles of the flower bud.

Pollination biology. The pollination syndrome in the related genera *Chamelaucium*, *Darwinia* and *Verticordia* involves the deposition of their pollen in an oily droplet onto a pollen presenter at the end of the style before the flowers open. This does not happen in *Pileanthus*. Very specific bee pollination has been documented in one species (*P. dilatatus*), which has bilobed stamens (Houston 1992).

Key to species of *Pileanthus*

1. Anther cells contiguous on club-shaped filaments.
 2. Leaves clustered on short side branchlets. Ovules 8 8. *P. peduncularis*
 2. Leaves not clustered. Ovules 4.
 3. Flowers pink or red. Style hairy at base.
 4. Flowers pink. Tepaline anthers erect 6. *P. bellus*
 4. Flowers red. Tepaline anthers incurved 7. *P. rubronitidus*
 3. Flowers orange. Style glabrous 5. *P. auranticus*
1. Anther cells on forked filaments.
 5. Flowers cerise or red.
 6. Flowers cerise. Petals 12–15 mm long. Bracteole umbo pointed 1. *P. filifolius*
 6. Flowers red. Petals 8–11 mm long. Bracteole umbo blunt 2. *P. vernicosus*
 5. Flowers white or pale pink.
 7. Leaves c. 1 mm wide. Petals pale pink or white with pink to red centre, c. 8 mm long 4. *P. limacis*
 7. Leaves c. 0.3 mm wide. Petals white, 3–4 mm long 3. *P. septentrionalis*

1. *Pileanthus filifolius* Meisn., *J. Linn. Soc.*, Bot. 1: 45 (1857). Type: “in planitie arenosa prope Colbourne Springs.” [Colburn Salt Springs, near Arrowsmith River, Western Australia], 1850–1851, J. Drummond 6th coll., no. 42” (iso: K, MEL).

Shrub to 1 m high. *Young branches* glabrous, brown, with occasional raised oil glands, becoming grey and shedding glands; leaf decurrencies prominent, raised, 3-angled, almost winged below attachment. *Leaves* not densely clustered, linear, triquetrous but flattened at base, (6)7–13(20) mm long, c. 1 mm wide, gland-dotted, apex acute. *Peduncle* 7–20 mm long, circular to elliptic in cross-section, glabrous. *Bracteole pair*: cup bilobed, 3–5 mm long; free portions 6–8 mm long, brown, gland-dotted, with a pungent umbo 1–2 mm long. *Hypanthium* broadly campanulate, 6–8 mm long, pilose. *Sepals* imbricate, 4–6 mm long, 3–4 mm wide, striate, lacinate, silky-pilose outside, glabrous inside, margins membranous, apex obtuse. *Petals* overlapping, 12–15 mm long, 9–14 mm wide, cerise, margin lacinate-dentate. *Androecium* with bilobed filaments; antipetaline filaments 1.5–2 mm long; antisepaline filaments c. 1 mm long. *Ovules* 4. *Style* 4–6 mm long, glabrous; stigma globose, inconspicuous. (Figure 1A–D)

Selected specimens examined. WESTERN AUSTRALIA: Three Springs, 24 Sep. 1940, W.E. Blackall 4898 (PERTH); Arrino, Dec. 1945, C.A. Gardner (PERTH); 2 km SSE of Mt Lesueur, 5 Dec. 1979,

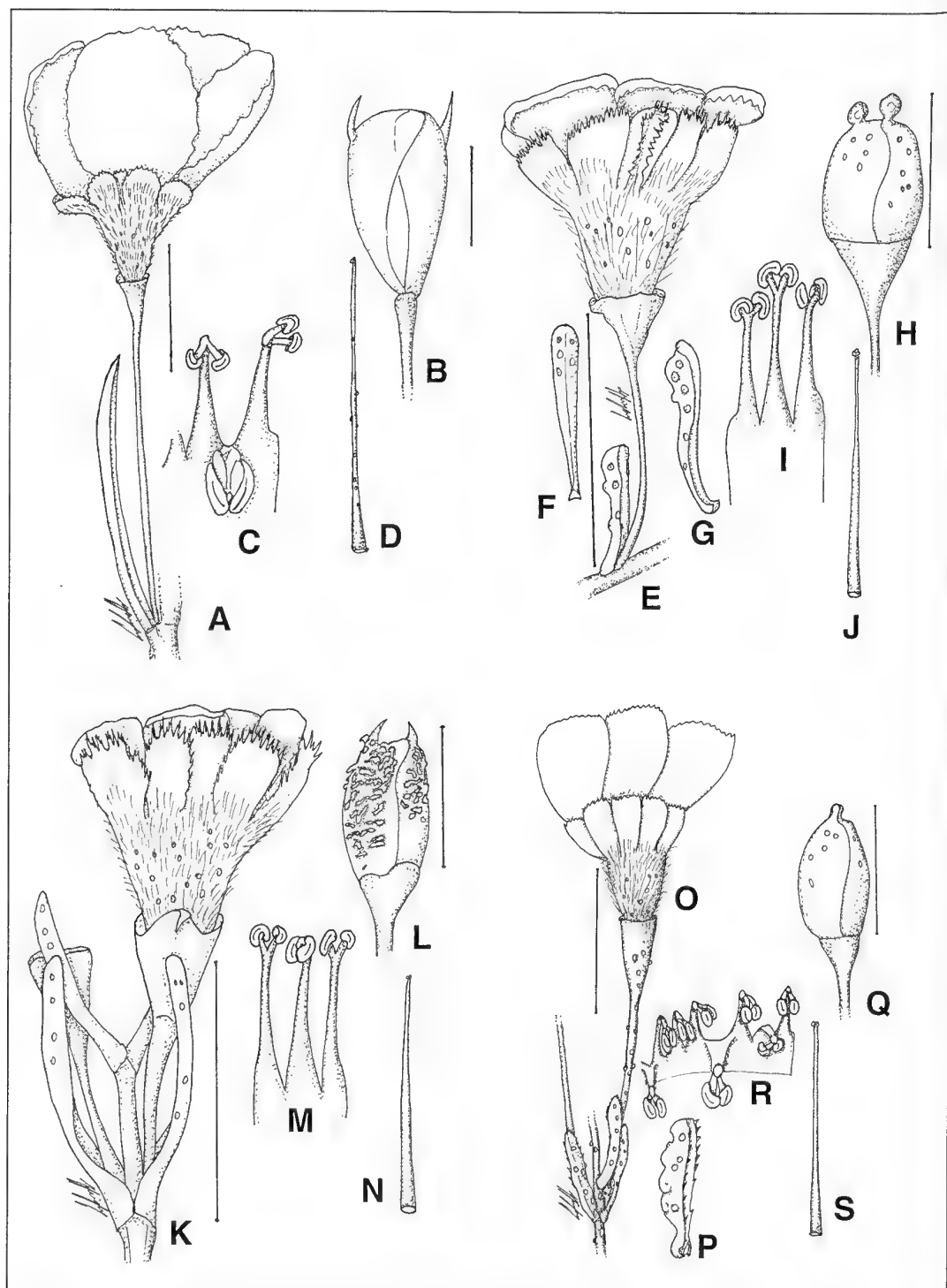


Figure 1. A-D. *Pileanthus filifolius*. A – leaf and flower, B – bracteoles, C – stamens, D – style; E-J. *P. limacis*. E – leaf and flower, F – leaf from below, G – leaf from side, H – bracteoles, I – stamens, J – style; K-N. *P. septentrionalis*. K – flowering branchlet, L – bracteoles, M – stamens, N – style; O-S. *P. vernicosus*. O – leaves and flower, P – leaf, Q – bracteoles, R – stamens, S – style. Drawn from C.A. Gardner 5 Jan. 1931 (A-D), S.J. Claymore & A.S. Weston 264 (E-J), C.A. Gardner 3184 (K-N) and A.S. George 16949 (O-S). Scale bars for bracteoles = 5 mm, for flowers = 10 mm.

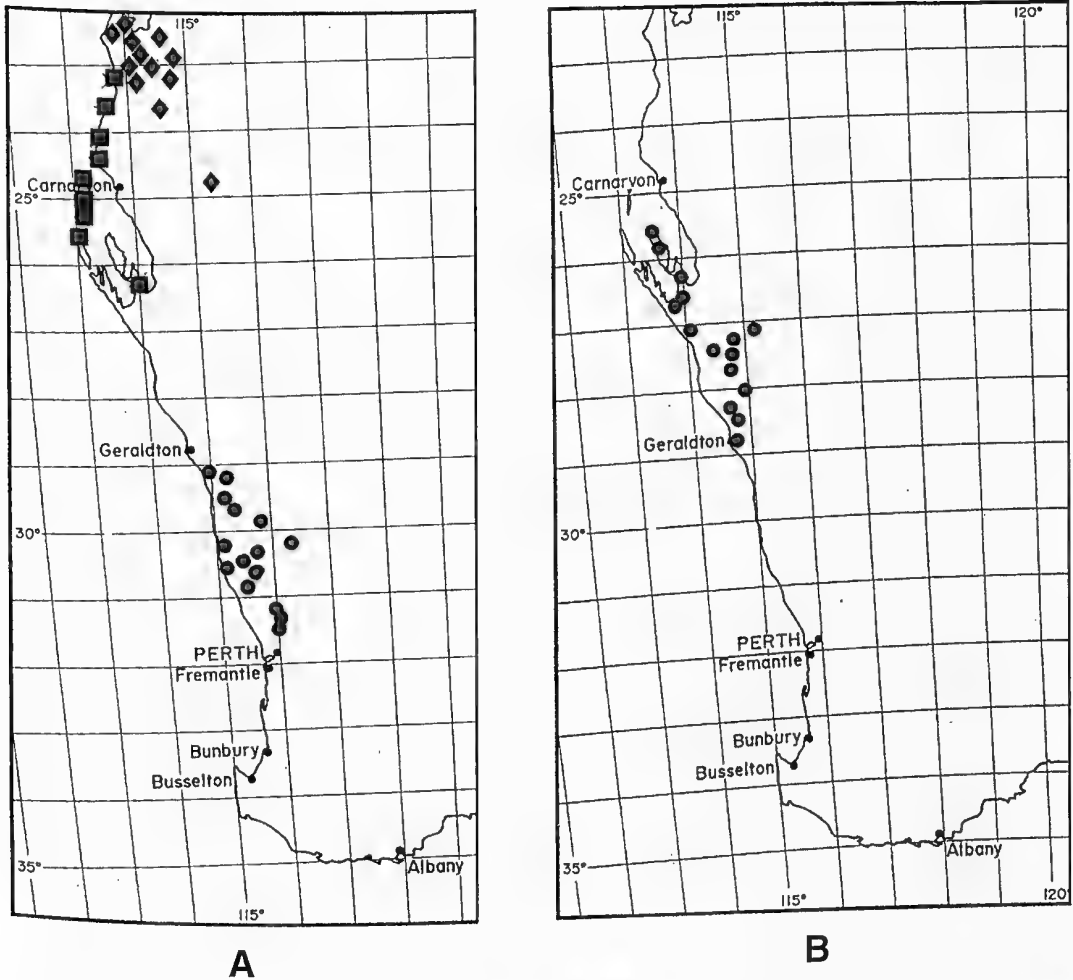


Figure 2. Distribution maps. A – *Pileanthus filifolius* ●, *P. limacis* ■ and *P. septentrionalis* ◆; B – *P. vermicosus* ●.

E.A. Griffin 2661 (PERTH); Bartlets Well Reserve, N of Gingin, 22 Jan. 1987, G.J. Keighery & J. Alford 1584 (PERTH); Mingenew, 8 Nov. 1956, A.R. Main (PERTH).

Distribution and habitat. Occurs between Dongara, inland to Mingenew and south to north of Gingin. Grows on sand or lateritic sand, in *Banksia hookeriana* heath, *Banksia* low woodland and *Eucalyptus tottiana* Mallee over heath. (Figure 2A)

Flowering period. Flowering mainly December to January.

Conservation status. Widespread and well conserved. Recorded for at least eight nature reserves and five National Parks.

Etymology. From the Latin *filum* (thread) and *folium* (leaf), referring to the filiform leaves of this species.

Notes. Houston (1992) documented the pollination of this species by the monoleptic bee, *Euryglossa semaphore*. Further studies on the pollination of the genus are underway. This species has the largest flowers of the genus.

See the notes given under *Pileanthus peduncularis* regarding the application of the name *Chamelaucium dilatatum*.

2. *Pileanthus vernicosus* F. Muell., *Fragm. Phyt. Austral.* 1, 225 (Dec. 1859). *Type citation*: "Ad flumen Murchison. Oldfield et Walcott." [Murchison River, Western Australia], *Oldfield* (syn: MEL!).

Upright slender *shrub* to 1 m tall. *Young branches* brown, oil glands prominent; leaf decurrencies obvious, with red triangular-shaped stipules in axils. *Leaves* clustered on short opposite shoots, linear-triangular, 3–5(9) mm long, c. 1 mm wide, oil glands prominent, margins and midrib with prominent tooth-like hairs, apex truncate to acute. *Floral leaves* similar to vegetative leaves but not as clustered. *Peduncle* slender, 7–15 mm long, with prominent oil glands. *Bracteole pair*: cup c. 3 mm long, 1–2 mm wide; free portions 3–5 mm long, with midrib not prominent, margins entire, umbo not obvious but apex area thickened with prominent oil glands. *Pedicel* 2–3 mm long. *Hypanthium* campanulate, 3–4 mm long, c. 3 mm diam., silky-pilose, adnate portion 2–2.5 mm long. *Sepals* oblong, c. 3 mm long, c. 2 mm wide, with scattered hairs becoming silky-pilose towards base, apex obtuse. *Petals* 8–11 mm long, 7–9 mm wide, red with base pinkish, margins laciniate, apex blunt. *Androecium*: antipetaline filaments conspicuously bilobed, 1–1.5 mm long; antiseppaline filaments less prominently bilobed, less than 1 mm long. *Ovules* 4. *Style* 2–3 mm long, glabrous; stigma globose, inconspicuous. (Figure 1O–S)

Selected specimens examined. WESTERN AUSTRALIA: Cape Lesueur, Peron Station, 9 Nov. 1982, R.J. Cranfield 2527 (PERTH); Cooloomia Nature Reserve, 19 Sep. 1979, S.D. Hopper 1385 (PERTH); 40 km N of Geraldton on North West Coastal Highway, K.F. Kenneally 4707 (PERTH); 392 mile peg [85 km] N of Geraldton, 18 Sep. 1974, B.L. Powell 74140 (PERTH); Kalbarri National Park, R.C. Wemm 1 (PERTH).

Distribution and habitat. Occurs between Geraldton and Peron Peninsula, Shark Bay. Grows on red or yellow sand in *Banksia sceptrum* shrubland, Tree heath, coastal heath and Acacia shrubland. (Figure 2B)

Flowering period. Between mid September and early November.

Chromosome number. $n=11$ (Rye 1979), voucher B.L. Powell 74140 [as *Pileanthus* sp. 1].

Etymology. From the Latin *vernicosus* abounding in varnish, probably referring to the shiny oily coating on the young floral buds.

Conservation status. Restricted in occurrence but well conserved in Kalbarri National Park, Zuytdorp National Park and proposed reserves within the Shark Bay World Heritage area.

Notes. Closely related to *Pileanthus filifolius*, a northern replacement for that species. A single record notes plant size as 2.5 m high by 2.5 m across.

3. *Pileanthus septentrionalis* Keighery, *sp. nov.*

Frutes effusus circa 1 m altus et 4 m latus. Folia linearia, triquetra, 3–8 mm longa, 0.3 mm lata. Petala non-imbricata, 3–4 mm longa, 2–3 mm lata.

Typus: Wogoola, near Winning Pool, Western Australia, 28 August 1932, C.A. Gardner 3184 (*holo:* PERTH 02504278; *iso:* CANB, MEL, PERTH 02504268, 02504324).

Spreading open *shrub*, to 1.5 m tall, to 4 m wide. *Branches* pale brown with glandular extrusions, prominent on older branches. *Leaves* linear, triquetrous but flattened towards base, 4–7 mm long, c. 3 mm wide, with prominent raised oil glands, apex obtuse. *Peduncle* (4)6–11(15) mm long, with prominent oil glands. *Bracteole pair:* cup to 4 mm long; free portions to 7 mm long, brown, prominently gland-dotted, with a pungent conical umbo 0.5–1 mm long. *Hypanthium* to 5 mm long, to 4 mm wide, free part 0.5–0.75 mm long, white-hirsute, with oil glands. *Sepals* chartaceous, c. 3 mm long, c. 3 mm wide, hirsute outside, margins dentate. *Petals* not overlapping, 3–4 mm long, 2–3 mm wide, white, apex lacinate-dentate. *Androecium:* antipetaline filaments bilobed, to 3 mm long; antisepaline filaments not deeply bilobed, to 1.5 mm long. *Ovules* 4. *Style* to 5 mm long, glabrous; stigma minute, globose. (Figure 1K–N)

Selected specimens examined. WESTERN AUSTRALIA: 42 km WSW of Barradale Roadhouse on North West Coastal Highway, 2 Sep. 1988, D.J. Edinger 640 (PERTH); Wogoola Station, near Winning Pool, 28 Aug. 1932, C.A. Gardner 3184 (PERTH); 8 miles [12 km] S of Learmonth, 31 Aug. 1960, A.S. George 1413 (PERTH); 35 km NW of Mt Sandiman, Kennedy Range, 21 Aug. 1987, K.R. Newbey 11721 (PERTH); cultivated at Kings Park, ex 303 km N of Carnarvon, 14 Feb. 1973, B.L. Powell 73026 (PERTH).

Distribution and habitat. Occurs between Cape Range and the Kennedy Range, on the Eastern side of Lake McLeod on red sand dunes. (Figure 2A)

Flowering period. August to October.

Chromosome number. $n=11$ (Rye 1979), voucher B.L. Powell 73026 [as *Pileanthus* sp. aff. *limacis*].

Conservation status. Widespread and well conserved. Present in Cape Range, Kennedy Range National Parks, Dorre and Bernier Nature Reserves.

Etymology. The epithet is derived from a Latin word for northern. This is the northern-most member of the genus.

Notes. Closely related to *P. limacis* but differing in the smaller white flowers with non overlapping petals and the thin leaves. Note that D.J. Edinger 640 differs from the other specimens in having stipules.

4. *Pileanthus limacis* Labill., Nov. Holl. Pl. Sp. 2, 11, t. 149 (Feb. 1806). *Type:* “in terrâ Van-Leeuwin” [Western Australia] (FI!).

Low spreading or prostrate *shrub* to 80 cm tall, to 1 m wide. *Young branches* hidden by leaf decurrencies or rarely red-brown, gland-dotted, becoming grey and shedding glands. *Leaves* crowded

at ends of branches, 5–8 mm long, c. 1 mm wide, covered by oil glands, adaxial surface flat, adaxial curved, margins hyaline with small tooth like projections, apex obtuse. *Peduncle* 4–8(15) mm long. *Bracteole pair*: cup 2–3 mm long; free portions 4–6 mm long, 4–5 mm wide, brown, with conspicuous oil glands, soon caducous, with a more or less globular umbo c. 1 mm long. *Hypanthium* broadly campanulate, 4–5 mm long, 4–5 mm wide, silky-pilose, gland-dotted. *Sepals* deeply divided, lobes 3–5 mm long, 4–5 mm wide, slightly pilose, apex obtuse, dentate. *Petals* overlapping, c. 8 mm long, c. 6 mm wide, white with centre flushed pink to red, or pale pink, margins laciniate, apex rounded. *Androecium*: antipetaline stamens bilobed, to 3 mm long; antisepaline stamens not deeply bilobed, c. 2 mm long. *Ovules* 4. *Style* c. 5 mm long, glabrous; stigma minute, globular. (Figure 1E–J)

Selected specimens examined. WESTERN AUSTRALIA: Blowholes, Quobba Station, 18 July 1964, J.S. Beard 3480 (PERTH); Waroora Station, near homestead, Sep. 1962, J.C. Malone s.n. (PERTH); Dorre Island, Disaster Cove, 15 July 1959, R.D. Royce 5876 (PERTH); N end of Bernier Island, 5 Oct. 1947, D.L. Serventy s.n. (PERTH).

Distribution and habitat. Occurs in near coastal situations and offshore islands from Shark Bay to Waroora Station, on coastal dunes usually over limestone. (Figure 2A)

Flowering period. July to October, depending on rainfall.

Conservation status. Widespread and not endangered.

Etymology. From *limacis* Greek for slug, owing to the short fat leaves having a resemblance to a slug.

Notes. Although often noted as having white flowers, this species normally has pale pink flowers or white flowers suffused pink unlike *P. septentrionalis* where they are invariably white. *Pileanthus limacis* and *P. septentrionalis* occur entirely within the arid Carnarvon Basin, one along the coast and the other inland.

5. *Pileanthus auranticus* Keighery, *sp. nov.*

Futex erectus, 2.5 m altus. Differt a *Pileantho bello* foliis 10–17 mm versus 4–12 mm longis. Flores auranticis, umbonibus curvatis longis pungentibus.

Typus: 30.1 km west of North West Coastal Highway on Vermin Proof Fence, 27°15'S, 114°19'E, Western Australia, 21 October 1995, M.N. Lyons 2379 (*holo*: PERTH; *iso*: CANB, K, MEL).

Upright woody *shrub* to 2 m tall, densely branched at base. *Young branches* with raised oil glands and occasional hairs; leaf decurrences prominent, becoming grey and shedding. *Leaves* not densely clustered, linear, 10–17 mm long, c. 1 mm wide, with raised oil glands, upper surface deeply grooved, undersurface convex, apex acute. *Peduncle* filiform 15–20 mm long, with prominent oil glands. *Bracteole pair*: cup 3–4 mm long; free portions 9–11 mm long, greenish yellow, with prominent oil glands, with a curved pungent umbo 3–4 mm long. *Hypanthium* narrow-campanulate, 5–6 mm long, 3–4 mm diam., free part c. 2 mm long. *Sepals* deeply divided, lobes 3–4 mm long, 4–5 mm wide, slightly pilose, apex obtuse, dentate. *Petals* overlapping, c. 8 mm long, c. 6 mm wide, orange, margins laciniate, apex rounded. *Androecium* with entire filaments; antipetaline stamens c. 2 mm long; antisepaline stamens 0.5–1 mm long. *Ovules* 4. *Style* c. 5 mm long, glabrous; stigma minute. (Figure 3A–E)

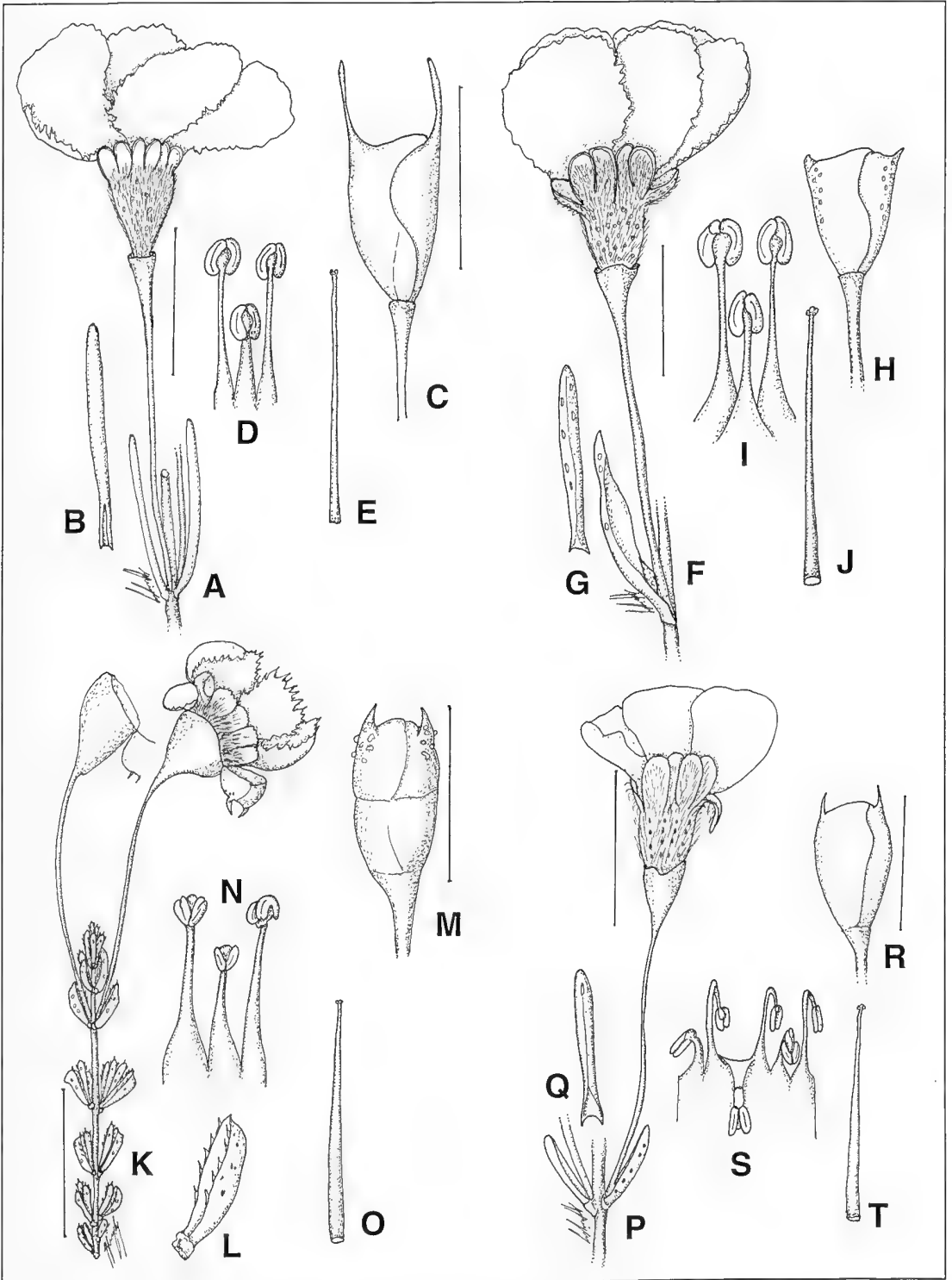


Figure 3. A-E. *P. auranticus*. A – leaves and flower, B – leaf, C – bracteoles, D – stamens, E – style; F-J. *Pileanthus bellus*. F – leaf and flower, G – leaf, H – bracteoles, I – stamens, J – style; K-O. *P. peduncularis* subsp. *peduncularis* K – leaf and flower, L – leaf, M – bracteoles, N – stamens, O – style; P-T. *P. rubronitidus*. P – leaves and flower, Q – leaf, R – bracteoles, S – stamens, T – style. Drawn from M.N. Lyons 2380 (A-E) B. & D. Bellairs 4026 (F,G,I,J), C.A. Gardner 16289 (H), R.D. Royce 9380 (K-O) and S. DeLa Hunt Oct. 1961 (P-T). Scale bars for bracteoles = 5 mm, for flowers = 10 mm.

Other specimens examined. WESTERN AUSTRALIA: near northern boundary of Murchison House Station on Vermin Proof Fence, 29 Oct. 1986, A.S. George 16848 (PERTH); 32.3 km W of North West Coastal Highway on Vermin Proof Fence, 21 Oct. 1995, M.N. Lyons 2380 (PERTH); 32.6 km west of North West Coastal Highway towards Zuytdorp Cliffs, 1 Nov. 1985, P. Roberts 755 (PERTH).

Distribution and habitat. Found on the north-west corner of the Eurady sand sheet, in undulating sandplain dominated by *Actinostrobos arenarius* shrubland over low heath. In this area all collections are from interdunal sites on yellow sand over yellow sandy clays. One collection has been recorded on red sand over limestone in low mixed heath closer to the coast. (Figure 4A)

Flowering period. Recorded flowering in October.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Has a very restricted range and populations are entirely on pastoral lands in Murchison House Station. It is highly likely the species also occurs in the adjoining Shark Bay World Heritage area.

Etymology. From the Greek *auranticus* for the orange flowers of this species.

Notes. Closely related to *Pileanthus bellus*, differing in the longer slender floral leaves, curved pungent umbo and orange flowers. The two species do not appear to occur together or overlap in distribution. *Pileanthus bellus* occurs on the tall yellow sand dunes of the Eurady Dune System (as does another endemic of these dunes, *Verticordia coolomia*) which occurs to the east of the range of *P. auranticus*.

6. *Pileanthus bellus* Keighery, *sp. nov.*

Frutex erectus, 3 m altus. Foliis 4–12 mm longis. Differt a *Pileantho aurantico* floribus roseis, umbonibus brevibus pungentibus.

Typus: near number one tank [North West Coastal Highway, just north of Murchison River crossing], Western Australia, 2 November 1965, C.A. Gardner 16289 (*holo:* PERTH 04365550; *iso:* CANB, K, MEL).

Erect shrub to 3 m tall. Young branches brown, with prominent oil glands; leaf decurrencies not prominent, becoming grey and shedding, with large stipular outgrowths in the leaf axils. Leaves not densely clustered, linear, triquetrous, 4–12 mm long, c. 1 mm wide, glabrous, with prominent oil glands, adaxial surface grooved, abaxial convex, margin with scattered hairs but not hyaline, apex obtuse or acute. Peduncle slender, 10–15 mm long. Bracteole pair: cup narrowly turbinate, 2–3 mm long; free portions 4–6 mm long, brown, margins minutely denticulate, with a pungent conical umbo c. 1 mm long. Hypanthium turbinate, 3–5 mm long, 3–4 mm wide, silky-pilose, gland-dotted, free part 1–1.5 mm long. Pedicel 2–4 mm long. Sepals bilobed, 2–4 mm long, 3–4 mm wide, shortly pilose, apex obtuse, margin minutely toothed, fused for c. 1 mm at base. Petals 7–8 mm long, c. 8 mm wide, pink, base erose, margin entire. Androecium with entire filaments; antipetaline stamens c. 2 mm long; antisepaline stamens c. 1 mm long. Ovules 4. Style 4–7 mm long, ciliate at base; stigma minute. (Figure 3F–J)

Selected specimens examined. WESTERN AUSTRALIA: 10 km NW of North West Coastal Highway along track to Z bend, Kalbarri National Park, 30 Oct. 1996, B. & D. Bellairs 4026 (PERTH); 15 km

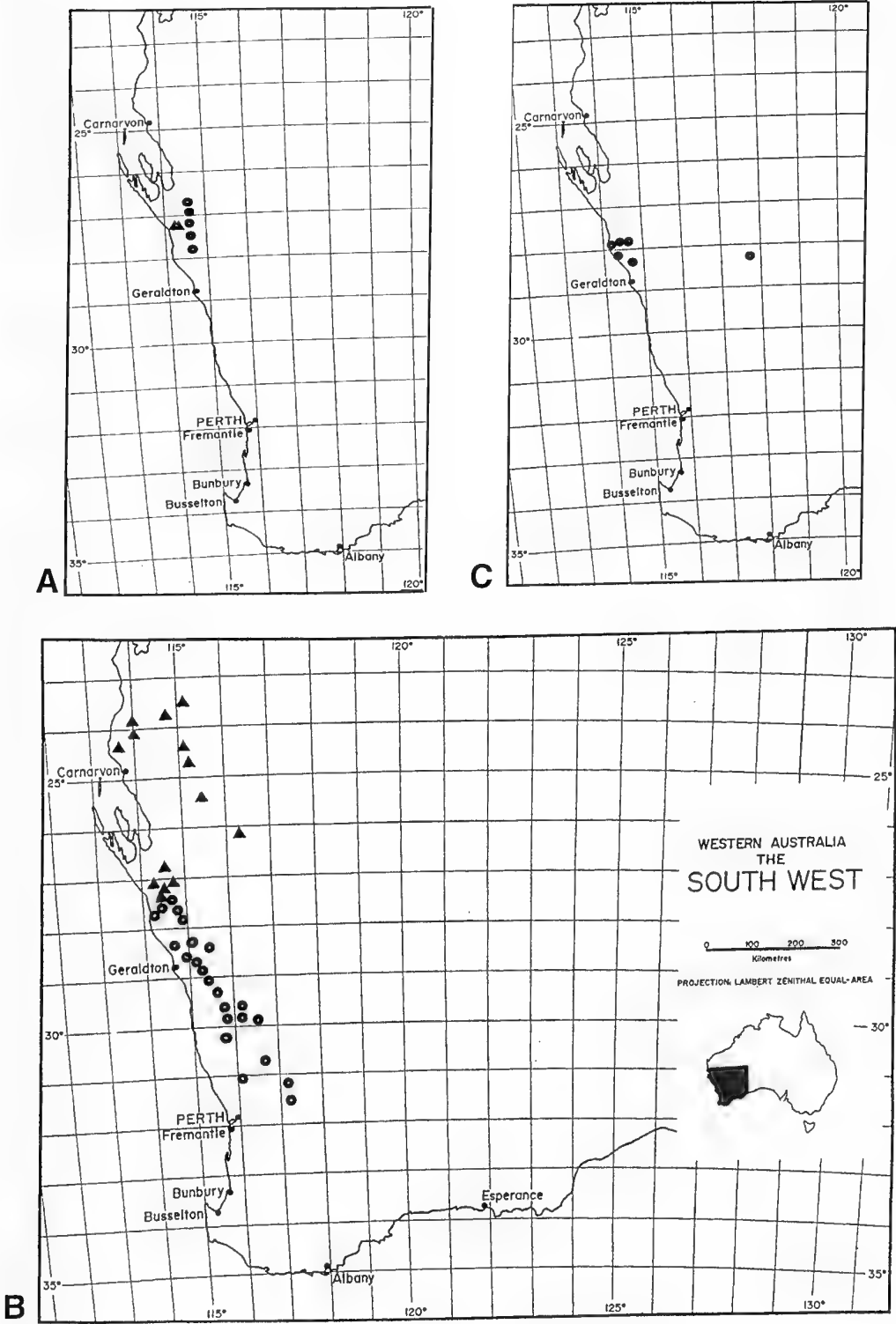


Figure 4. Distribution maps. A – *Pileanthus auranticus* ▲ and *P. bellus* ●; B – *P. peduncularis* subsp. *peduncularis* ● and *P. peduncularis* subsp. *piliferus* ▲; C – *P. rubronitidus*.

N of Murchison River Crossing on North West Coastal Highway, 12 Dec. 1984, *H. Demarz* 10489 (PERTH); 410 mile peg on North West Coastal Highway [157 km N of Geraldton], 30 Oct. 1963, *F. Lullfitz* 2848 (PERTH).

Distribution and habitat. Mainly confined to the Eurardy sand dunes, where it occurs on tall yellow dunes dominated by *Actinostrobos arenarius* shrubland, but also a disjunct southern record from shallow grey sands over sandstone emergent from low heath. (Figure 4A)

Flowering period. October to December.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Currently of restricted distribution, but present in Kalbarri National Park and adjacent uncleared pastoral and unallocated Crown lands. Probably not at risk, but requiring further survey.

Etymology. From the Greek, *bellus* for beautiful, referring to this species when in flower it is a stunning sight.

Notes. A putative hybrid (*A.S. George* 16858) between *Pileanthus bellus* and *P. peduncularis* has been collected at 45.8 km north of Galena Bridge, Murchison River on the North West Coastal Highway. This, if correct, is the only record of natural hybridisation in the genus.

7. *Pileanthus rubronitidus* Keighery, *sp. nov.*

Pileantho filifolio habitu et floribus apparenter similis, sed differt floribus rubris, petalis 7–8 mm versus 12–15 mm longis, staminibus non bilobis.

Typus: 4 km west-north-west of Yerina Spring, 28°04'S, 114°19'E, Western Australia, 1 October 1979, *J. Taylor* 1047, *M.D. Crisp* & *R. Jackson* (holo: PERTH 02503921; iso: BISH, CANB).

Erect shrub to 1 m tall. Young branches brownish-red, with prominent oil glands forming a sticky exudate; leaf decurrencies prominent, persistent, becoming grey, with large red stipular outgrowths in the leaf axils. Leaves not very clustered, linear, triquetrous, 5–13 mm long, less than 1 mm wide, glabrous, with prominent oil glands, adaxial surface grooved, abaxial convex, margin entire, apex obtuse or acute. Peduncle slender, (8)12–22 mm long, yellow-red. Bracteole pair: cup narrowly turbinate, 2–3 mm long; free portions 4–6 mm long, brown, margins minutely denticulate, with a conical pungent umbo c. 1 mm long. Pedicel 2–4 mm long. Hypanthium turbinate, 3–5 mm long, 3–4 mm wide, silky-pilose, gland-dotted, free part 1–1.5 mm long. Sepals 5, 2–4 mm long, 3–4 mm wide, the two lobes fused for c. 1 mm at base, shortly pilose, apex obtuse, margin minutely toothed. Petals 7–8 mm long, c. 8 mm wide, red-orange, base erose, margin entire. Androecium with entire filaments; stamens usually c. 1 mm long, (Mount Magnet collection much longer). Ovules 4. Style 4–7 mm long, ciliate at base; stigma globose, minute. (Figure 3 P–T)

Selected collections examined. WESTERN AUSTRALIA: Hutt River, *W.H. Butler* 198 (PERTH); Mount Magnet, 2 Oct. 1959, *W.H. Butler s.n.* (PERTH); cultivated at Kings Park, ex Murchison, 12 Feb. 1973, *B.L. Powell* 73025 (KPBG); 25 km E of Kalbarri, 7 Nov. 1986, *P. Roberts* 766 (PERTH).

Distribution and habitat. Occurs between Kalbarri and west of Northampton, with one very disjunct collection from Mount Magnet. This collection requires confirmation. Grows on grey sand over sandstone, white sand, in heath or *Banksia sceptrum* shrubland. (Figure 4C)

Flowering period. Between late September and early November.

Chromosome number. $n=11$ (Rye 1979), voucher B.L. Powell 73025 [as *Pileanthus filifolius*].

Conservation status. Well conserved in Kalbarri National Park.

Etymology. From the Latin: *rubro* meaning red and *nitidus* meaning shiny, referring to the shiny red petals of this species.

Notes. This species has been known informally as *Pileanthus* sp. Kalbarri (D. & B. Bellairs 1684). It has been frequently confused with *P. dilatatus* in the past, but differs in flower size, petal colour and in having entire stamens.

The isolated Mount Magnet collection of *P. rubronitidus* has longer stamens than the western material of this species. This highly disjunct population needs recollecting.

8. *Pileanthus peduncularis* Endl., Stirp. Herb. Huegel. 3, 196 (1838). *Type:* "In Novae Hollandiae austro-occidentalis interioribus, inter Swan river et King Georges Sound legit cl. Roe" between Swan River and King George Sound, interior of south-west [Western Australia], Roe (BM!, W, photograph seen).

?*Chamelaucium dilatatum* Drumm., *Hooker's J. Bot. Kew Gard. Misc.* 5: 402–403 (1853). *Type:* not specified but species described from north-east of Perth, Western Australia.

Low spreading *shrub* to 1.5 m tall by 3 m wide, usually less. *Young branches* brown, oil glands prominent, turning grey and shedding; leaf decurrences prominent, with small stipular outgrowths in the axils. *Leaves* clustered on short opposite shoots, linear or clavate, triquetrous, 2–4 mm long, glabrous or hairy, with prominent oil glands, margin often with tooth-like hairs, apex obtuse or subacute. *Floral leaves* not clustered, navicular, to 3 mm long, broader than vegetative leaves, base winged. *Peduncle* slender, 9–20 mm long, with prominent oil glands. *Bracteole pair:* cup 3–5 mm long, c. 3 mm wide; free portions 6–9 mm long, with prominent oil glands, midrib not prominent, margins entire, with a broadly conical umbo c. 0.5 mm long. *Pedicel* 2–3 mm long. *Hypanthium* campanulate, 3–5 mm long, 3–4 mm wide, silky pilose, adnate part 1–2 mm long. *Sepals* oblong or ovate, 3–4 mm long, c. 2 mm wide, silky pilose, gland-dotted or with tuberculate hairs, margin entire. *Petals* 7–9 mm long, 4–6 mm wide, orange throughout or with a purple or reddish base, margins lacinate. *Androecium* with entire filaments; stamens 1–2 mm long, purple or pinkish red. *Ovules* 8. *Style* 5–7 mm long, glabrous, purple, becoming paler at apex; stigma, globose, minute. **Coppercups**

Distribution. Occurs from Minilya to Bruce Rock (Figure 4B).

Conservation status. This is the most widely distributed species of *Pileanthus*, and both subspecies have quite large ranges.

Notes. The species *Chamelaucium dilatatum* Drumm., described by Drummond (1853: 403) as having vermilion petals and twenty stamens “united by a beautiful dark purple membrane” is probably a synonym of *Pileanthus peduncularis* as it appears to have been collected in an area where only that species occurs and because the description seems appropriate. However, it is also possible that the name applies to the species currently known as *P. filifolius*, in which case it would be the earliest description of that species and a new combination would be required. This needs to be investigated further.

Two morphologically distinct subspecies are recognised. They are largely geographically separated but overlap between Kalbarri and Nerren Nerren Station. No intermediates have been recorded in the area of overlap, but there has been little detailed collecting in this area. Until further studies of the variation in this species are completed it seems best to treat these geographical entities as subspecies.

Key to the subspecies of *Pileanthus peduncularis*

1. Leaves glabrous. Flowers orange with a purple or reddish base and purple anthers subsp. **peduncularis**
1. Leaves with scattered hairs. Flowers orange, sometimes with pinkish red anthers subsp. **piliferus**

8a. *Pileanthus peduncularis* Endl. subsp. **peduncularis**

Vegetative leaves glabrous. *Bracteoles* glabrous. *Petals* purple or reddish at the base, orange above. *Anthers* purple. (Figure 3 K–O)

Selected specimens examined. WESTERN AUSTRALIA: near Bruce Rock, Sep. 1929, *W.E. Blackall s.n.* (PERTH); 8 km E of Kalbarri, *L.A. Craven* 7063 (PERTH); 48 km S of Nerren Nerren Station, 8 Nov. 1979, *H. Demarz* 7739 (PERTH); Wongan Hills, 13 Nov. 1985, *H. Demarz* 11058 (PERTH); Mogumber, 9 Nov. 1897, *R. Helms s.n.* (PERTH); East Yuna reserve, 70 km NE of Geraldton, 12 Oct. 1976, *B.G. Muir* 382 (PERTH); Tammin National Park, 13 Nov. 1970. *R.D. Royce* 9380 (PERTH).

Flowering period. August to November.

Distribution and habitat. Occurs from Nerren Nerren Station south to Mogumber, inland to East Yuna, Wongan Hills and Bruce Rock, growing on sand usually in heath. (Figure 4B)

Chromosome number. $n=11$ (Rye 1979), voucher *B.L. Powell* 74092.

8b. *Pileanthus peduncularis* subsp. **piliferus** Keighery, *subsp. nov.*

Differt a *Pileantho peduncularis* subsp. *peduncularis* foliis piliferis eglanduligeris, floribus auranticis, antheris roseis, bracteolis piliferis tuberculatis.

Typus: 75 miles [121 km] north of Carnarvon on Onslow road, Western Australia, 24 August 1963, *J.S. Beard* 2997 (*holo:* PERTH 02506882; *iso:* KPBG).

Vegetative leaves covered in non-glandular hairs. *Bracteoles* covered in tubercular hairs. *Petals* orange throughout. *Anthers* orange or pinkish red.

Selected specimens examined. WESTERN AUSTRALIA: Kennedy Range, 23 Aug. 1965, J.S. Beard 4404 (PERTH); 20 km E of Kalbarri, 20 Nov. 1980, D.E. Bellairs 1686 (PERTH); Wogoola, Minilya River, 28 Aug. 1932, C.A. Gardner 3186 (PERTH); 45.8 km N of Galena Bridge on North West Coastal Highway, 29 Oct. 1986, A.S. George 16857 (PERTH); 76 miles [122 km] N of Carnarvon, Aug. 1963, J. Tonkinson s.n. (PERTH).

Distribution and habitat. Occurs from Minilya to Kalbarri. Grows on red or yellow sand dunes, or red, yellow or white sandy flats in *Banksia sceptrum* heath. (Figure 4B)

Flowering period. August to November.

Notes. This subspecies has been known as *Pileanthus peduncularis* subsp. *borealis* Keighery ms. It differs from *P. peduncularis* subsp. *peduncularis* in having either pure orange petals without any contrasting colour of red or purple at the base. Plants may have either orange or pinkish red anthers. The vegetative leaves are covered in non-glandular hairs and the bracteoles are covered with tubercular hairs.

Acknowledgements

This publication is dedicated to Neville Marchant, who first inspired the author to study this group of Myrtaceae, who accompanied him on several field trips and whose discussions on taxonomy have been instrumental in this paper. The author would like to thank the curators and staff of all Australian and overseas Herbaria who loaned collections or provided photographs of specimens and working space to enable this study to be undertaken.

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Two new species of *Comesperma* (Polygalaceae) from Western Australia

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Abstract

Keighery, G.J. Two new species of *Comesperma* (Polygalaceae) from Western Australia. *Nuytsia* 15(1): 53–57 (2002). Two new species of *Comesperma* Labill. from the south-west of Western Australia, *C. calcicola* Keighery and *C. griffinii* Keighery, are described and illustrated. Both species are regarded as poorly collected and in need of further survey to determine their conservation status. The great diversity of life forms found in south-western members of the genus is outlined.

Introduction

The genus *Comesperma* Labill. (Polygalaceae) is an endemic Australian genus of c. 31 species, with its centre of diversity in south-western Australia, where 17 species are currently recognized (Paczkowska & Chapman 2000) including 11 endemics. A secondary centre for the genus in Queensland has 13 species, of which six are endemic (Pedley 1984).

In northern and north-eastern Australia *Comesperma* taxa are mainly small woody shrubs (Thompson 1978). A greater variety of life forms is found in southern Australia, especially in Western Australia. In south-western Australia the shrub species are outnumbered by herbaceous or soft-wooded perennials. The shrub species include almost leafless (*C. scoparium* Steetz) and spinescent (*C. spinosum* F. Muell.) shrubs and woody climbers (*C. cilatum* Steetz, *C. integerrimum* Endl. and *C. volubile* Labill.).

The herbaceous group is diverse in the south-west of Western Australia and contains most of the endemic species, falling into three main life-form groups. The species *Comesperma acerosum* Steetz, *C. calymega* Labill., *C. confertum* Labill., *C. flavum* DC., *C. lanceolatum* (R. Br.) Benth., and *C. nudiusculum* DC. have tuberous taproots (Pate & Dixon 1982), and can escape summer drought and fire by dying back to these. Members of a second group of species (*C. drummondii* Steetz and *C. polygaloides* F. Muell.) have a spreading rootstock. They generally grow in fire-free habitats and die back in autumn before winter rains flood their habitat, but they also can form clones by rhizome spread in favourable wetland habitats. One of the new taxa (*C. calcicola*) described in this paper is part of this group of species and occupies the south-eastern margins of the south-west, where other members of the group are absent. At least one species, *C. rhadinocarpum* F. Muell., is a short-lived post-fire ephemeral with a corky rootstock. The second new species (*C. griffinii*) appears to be a post-fire ephemeral in this third group but occupies a larger range than *C. rhadinocarpum*, extending into the semi-arid zone of south-western Australia.

Taxonomy

Comesperma calcicola Keighery, *sp. nov.*

Comesperma drummondii affinis, a qua imprimis differt ramulis omino glabris, pedicellis brevis crassus.

Typus: southern margin of Truslove Nature Reserve, Western Australia, 20 October 2000, *G.J. Keighery & N.G. Gibson* 3127 (*holo*: PERTH; *iso*: CANB, K, MEL).

Soft perennial *sub-shrub* to 30 cm high, clonal from a spreading rhizome; tap root elongate and tuberous; ramets scattered over an area of several square metres. *Branchlets* erect, 1–5 per ramet, terete, glabrous, reddish green, young growth red to 10 cm, generally less. *Leaves* dense, crowded usually overlapping, grey-green, ovate, 5–9 mm long, 3–4 mm wide, thick, tapering to a petiole *c.* 1 mm long, apex acute, glabrous. *Racemes* terminal, up to 30 mm long. *Bracts and bracteoles* linear-obovate, caducous, *c.* 1 mm long, margins entire. *Pedicels* thick, 1–2 mm long. *Flowers* pinkish, glabrous. *Outer sepals* grey-green, 2-lipped, ovate, *c.* 1.5 mm long, apex obtuse, anterior ones connate nearly to apex. *Inner sepals* pinkish, obovate, *c.* 3 mm long. *Keel petal* enclosing the posterior petals. *Capsule* orbicular, narrowed at base, 5–6 mm long, 2–3 mm wide, apex acute. *Seeds* narrowly ovoid, *c.* 2 mm long, *c.* 1 mm wide, with long hairs filling lower part of capsule. (Figure 1A,B)

Other specimens examined. WESTERN AUSTRALIA: 21 km NNW of Mt Ragged, 33°17'S, 123°24'E, 17 Jan. 1989, *B. [W.R.] Archer s.n.* (PERTH); 0.5 km SE of Kau Rock, 65 km NE of Esperance, 13 Jan. 1990, *W.R. Archer* 1301901 (PERTH); 4 km S of Forrestiana crossroads towards Hatters Hill, 32°27'S, 119°45'E, 18 Oct. 1995, *B.J. Lepschi* 2185 (PERTH).

Distribution. Occurs between Mt Ragged, Truslove and Forrestiana in the Mallee Bioregion of south Western Australia.

Habitat. Grows in calcareous or semi-saline clay loams in Open Mallee or Chenopod shrublands.

Flowering time. Recorded in flower between October and January.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. This species is known from Truslove Nature reserve and uncleared unallocated crown lands. It has only been collected a few times and hence is in need of further survey to determine its conservation status.

Etymology. The epithet refers to the calcareous soils that this species prefers.

Affinities. This species is related to *Comesperma drummondii*, a species of clay-based wetlands of the Swan Coastal Plain, Jarrah Forest, Coolgardie and Avon-Wheatbelt Bioregions. This species differs in having leaves that are minutely pubescent and well displayed pink flowers in an almost corymbose raceme with long pedicels.

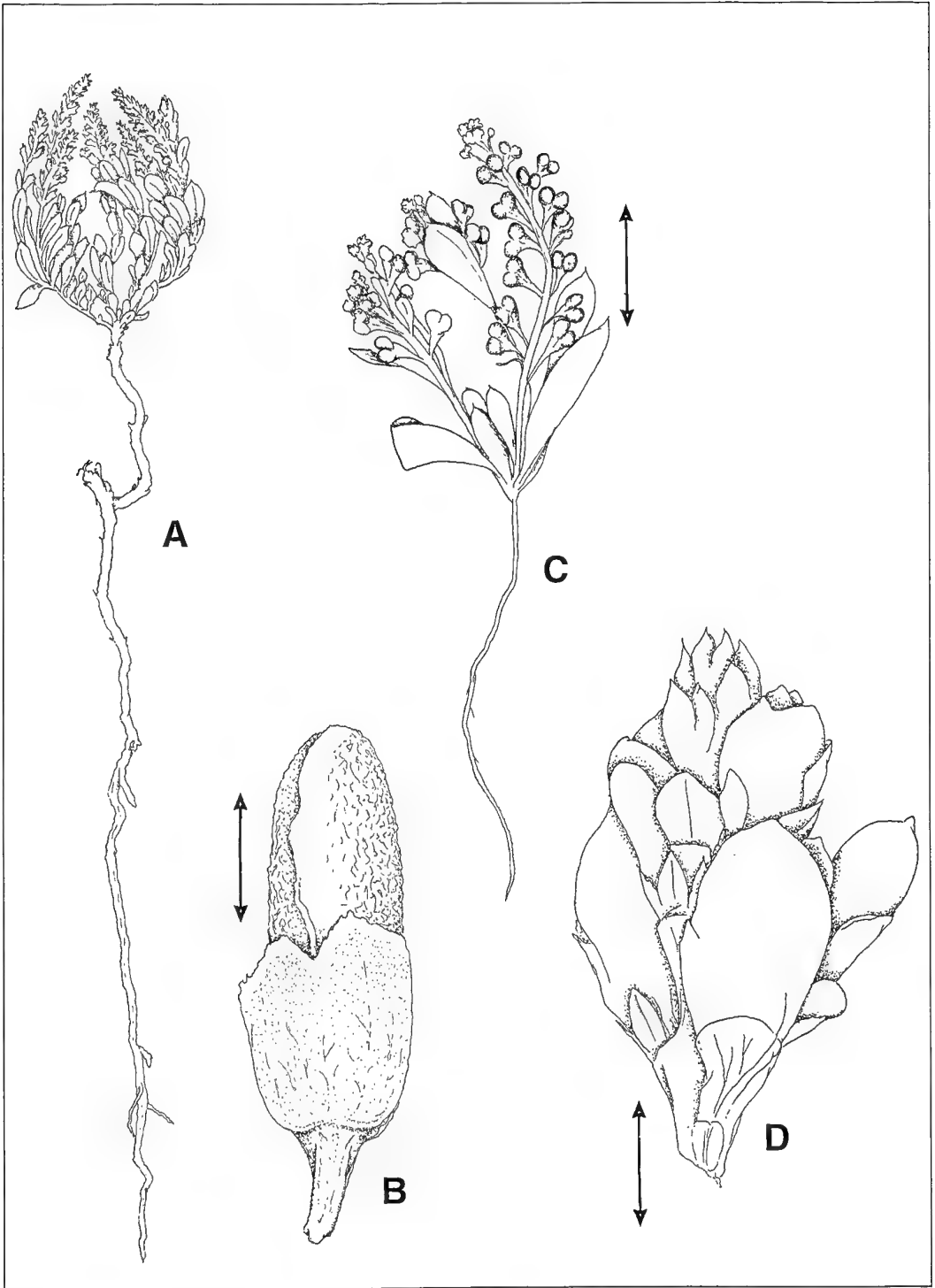


Figure 1. A,B – *Comesperma calcicola*, from NNW of Mt Ragged. A – whole plant (scale bar = 1 cm), B – flower (scale bar = 1 mm); C,D – *Comesperma griffinii*, from Indarra Nature Reserve. C – whole plant (scale bar = 1 cm), D – inflorescence (scale bar = 1 mm). Drawn by Nadine Guthrie from PERTH specimens W.R. Archer s.n. (A,B) and G.J. Keighery s.n. (C,D).

Comesperma griffinii* Keighery, *sp. nov.

Herbae annuae vel perennes erectae radice palari. Ramulus glabrus, sessilifolius, lamina attenuatus versus basis, rostulata. Flores albus, parvus.

Typus: Indarra Nature Reserve, on Ardingly South Rd, 20 km south-west of Mullewa, Western Australia, 25 October 1988, *G.J. Keighery s.n. (holo: PERTH)*.

Herb perennial or possibly annual, 5–15 cm tall, with a slender taproot. *Branchlets*, terete, glabrous, reddish green, young growth red. *Leaves* clustered at base forming an apparent rosette, scattered above, sessile but narrowed at base, narrowly oblong-ovate, flat, 12–20 mm long, c. 6 mm wide, apex a short recurved mucrone, margin entire, glabrous. *Raceme* erect, 12–18 mm long. *Flowers* white, small, glabrous. *Bracts and bracteoles* narrowly obovate, small and membranous, caducous, apex acute. *Outer sepals* free, membranous, obovate, c. 1 mm long, apex acute. *Inner sepals* white, obovate, c. 2 mm long. *Keel petal* white, c. 2 mm long, enclosing posterior petals. *Capsule* orbicular with narrowed base, 3–4 mm long, c. 2 mm wide, apex acute. *Seeds* narrowly ovoid, c. 1 x 1 mm, with long hairs filling lower part of capsule. (Figure 1C,D)

Other specimens examined. WESTERN AUSTRALIA: Allied Eneabba Leases, 15 km S of Eneabba, 29°56'S, 115°16'E, 30 Oct. 1978, *E.A. Griffin* 1405 (PERTH); Petrudor Rock Reserve, SE of Dallwallinu, 7 Nov. 1999, *M. Hislop* 1883 (PERTH); 60 km NE of Wubin, 1.5 km E of Great Northern Highway on road to Mt Gibson Station, 24 Oct. 1992, *A.M. Lyne* 864, *L. Craven & F. Zich* (AD, CANB, MEL, PERTH).

Distribution. Scattered occurrences from Eneabba north to near Mullewa inland to Mount Gibson Station and south to near Dalwallinu.

Habitat. Grows in yellow or grey sand in heath or shrublands.

Flowering and fruiting time. Recorded in flower and early fruit in October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Two. An uncommon species, but probably overlooked because of its small size and inconspicuous flowers.

Etymology. The epithet honours botanist E.A. (Ted) Griffin whose numerous collections, ecological studies and publications have greatly added to our knowledge of the flora of the northern sandplains.

Affinities. This species is not closely related to any other *Comesperma* species, although its habit is suggestive of a relationship to *C. rhadinocarpum* and perhaps more distantly to *C. drummondii*. However, it differs markedly from both species in having small white flowers and a very compact habit.

Acknowledgements

Observations on live material and collections of *Comesperma calcicola* were made during biological surveys undertaken as part of the Salinity Action Plan. Nadine Guthrie drew the illustrations.

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Drosera pedicellaris (Droseraceae), a new species from south-west Western Australia

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Abstract

Lowrie, A. *Drosera pedicellaris* (Droseraceae), a new species from south-west Western Australia. *Nuytsia* 15(1): 59–62 (2002). A new species, *Drosera pedicellaris* Lowrie, is described and illustrated. It is related to *D. parvula* Planchon and is known from only two localities in the south-west of Western Australia.

Introduction

Since the treatment of *Drosera* L. (Droseraceae) in “Flora of Australia” was published (Marchant & George 1982), a number of additional members of the genus from south-western Australia have been delimited or newly discovered. One new species that was discovered in 1997 is described here. It belongs in sect. *Rorella* of *Drosera* subgen. *Rorella* (DC.) Diels. Members of sect. *Rorella* are known as the Pygmy Droseras because of their minute size, with plants ranging from about 1 to 4 cm in diameter. They are also characterized by having a prominent central stipule bud, asexually reproducing by gemmae, and a great variety of flower colours including white, pink, yellow, metallic orange or combinations of these colours, often with a black, maroon, red or purple centre.

Including the new species, 44 species of Pygmy *Drosera* are now recognised. All are found in south-west Western Australia, with one species (*D. pygmaea*) extending to all other states (except Northern Territory) of Australia as well as New Zealand.

Taxonomy

Drosera pedicellaris A. Lowrie, *sp. nov.*

Drosera parvulae Planchon affinis sed apice gemmae stipulae parte laxa byssacea acuta carenti: petalis albis prope basim macula distincta rubro-marronina carenti; bracteolis per inflorescentias praesentibus; pedicellis longissimis differt.

Typus: Dookanooka Rd, c. 15 km south-west of Three Springs, 29°39'S, 115°39'E, Western Australia, A. Lowrie 1980, 14 November 1997 (*holo:* PERTH 05849489; *iso:* MEL).

A fibrous-rooted *perennial herb* with leaves semi-erect (inner younger ones) and more or less horizontal (older outer ones), arranged in an open rosette, 1–1.8 cm diam., older specimens always positioned above the soil surface. *Stem* 8–15 mm long, covered with the remains of previous seasons' leafy growth. *Active leaves* 12–20 per rosette, often reduced in number towards the end of anthesis; petiole 4–5 mm long, 0.4–0.5 mm wide at the base, 0.7–0.8 mm wide just above the base then tapering to 0.1–0.2 mm wide at the lamina, semi-lenticulate in section c. 0.2 mm thick, sparsely covered with a few scattered translucent-white minute glands on the adaxial and abaxial surface as well as the margins. *Lamina* ± orbicular, 0.9–1.3 mm diam., adaxial surface with insect-catching glands positioned around the margins and smaller glands within, abaxial surface sparsely glandular. *Stipule bud* broadly ovoid, shaggy, fimbriate, 5–6 mm long, 4–5 mm diam. at the base; stipules 4.5–6 mm long, 2.5–3.5 mm wide, 0.8–1 mm wide at the base, 3-lobed; central lobe lacerated into 3 segments, each divided into 3–4 laciniae at the apex, lateral segments upper outer margins serrate, lateral lobes upper outer margins serrate, remainder entire, apex and inner margin divided into 6–7 laciniae, the innermost lacinia exceeding the longest laciniae of the central lobe. *Flowering stems* 1–3 per basal rosette, 3.5–5.5 cm (mostly 4–5 cm) tall, very sparsely covered with translucent-white glandular trichomes c. 0.05 mm long; scape thread-like; cyme helicoid, with 15–20 or more flowers. *Pedicels* 5–6 mm long, horizontal and semi-erect in fruit within the same inflorescence, sparsely covered with translucent-white glandular trichomes c. 0.05 mm long. *Bracteoles* filiform, 0.8–1 mm long, c. 0.05 mm wide at the base, glabrous. *Sepals* broadly ovate to elliptic, 1–1.2 mm long, 0.8–1 mm wide, lowermost margins entire, upper margins and apex ± irregularly dentate, surface bearing a few scattered translucent-white glandular trichomes near the base. *Petals* adaxial surface white with a green wedge-shaped section at the base, abaxial surface white, obovate, margins entire, apex ± crenate, 2.8–3.5 mm long, 1.7–2.2 mm wide. *Stamens* 5, 0.6–0.8 mm long, filaments greenish white, anthers white with reddish spots, pollen glassy orange. *Ovary* greenish white, turbinate, c. 0.6 mm long, c. 0.6 mm diam. *Styles* 3, reddish at the base remainder white, almost horizontal, terete, c. 0.1 mm diam., c. 0.5 mm long; stigmas white, almost horizontal, terete, 1–1.5 mm long, gradually dilated to 0.12–0.15 mm diam. near the centre and towards the rounded apex, papillose. *Gemmae* broadly ovate, c. 1 mm long, c. 0.7 mm wide, c. 0.4 mm thick. *Seed* ± ellipsoid, 0.4–0.5 mm long, 0.35–0.4 mm diam.; micropyle c. 0.05 mm long, c. 0.05 mm diam.; testa black, very shallowly reticulate. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: Welton Well Rd, 29°42'S, 115°42'E, 14 Nov. 1997, A. Lowrie 1982 (PERTH).

Distribution. Known from two locations 7.4 km apart from each other in an area c. 15 km south-west of Three Springs.

Habitat. Grows in deep beige sand soils between and under low shrubs on heathland.

Phenology. Flowering October to November.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. *Drosera pedicellaris* is currently only known from two locations, but is locally abundant at both localities and it is highly probable that with further exploration more locations for this species will be found (see notes below). The taxon is not believed to be under threat but is in need of further survey.

Etymology. The epithet *pedicellaris* is named from the Latin *pedicellus* – pedicellate, and the suffix *aris* – provided with, in reference to the long distinctive pedicels of this species.

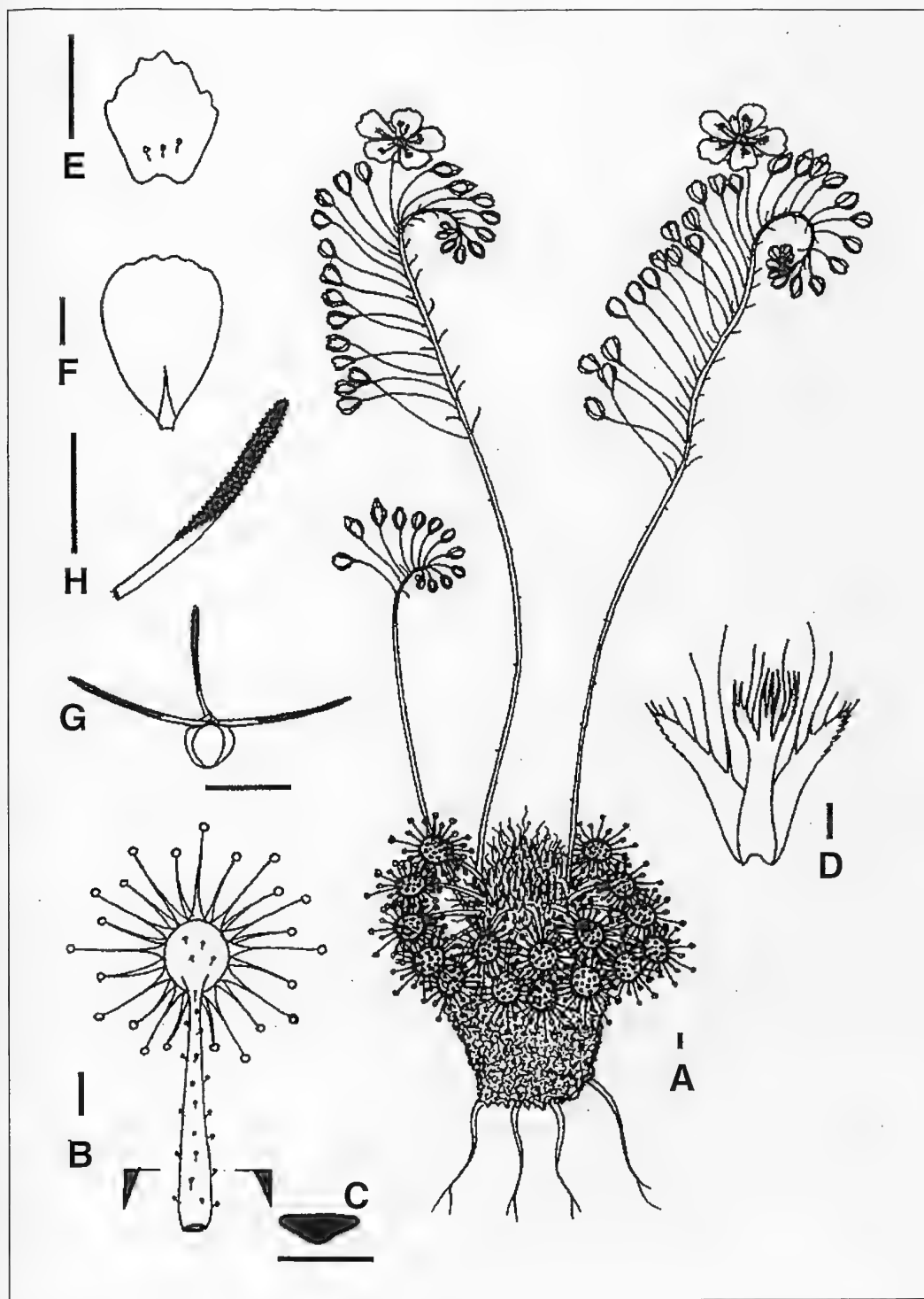


Figure 1. *Drosera pedicellaris*, drawn by A. Lowrie in 1997 from live material from the type location. A – habit; B – leaf; C – transverse section of petiole; D – stipule; E – sepal; F – petal; G – gynoeceium; H – style. All scale bars = 1 mm.

Affinities. *Drosera pedicellaris* may be confused with *D. parvula* Planchon (as illustrated in Lowrie 1989: 134–137) which also has small white flowers. *D. pedicellaris* is easily distinguished from this species by having a stipule bud lacking a loose point at the apex, white flowers lacking a distinctive reddish maroon spot near the base of each petal, bracteoles present throughout the inflorescence, and very long pedicels.

Within the pygmy *Drosera* section only one other taxon from the sand plains north of Perth, *D. nitidula* subsp. *allantostigma* Marchant & Lowrie (as illustrated in Lowrie 1989: 90–93), which also has small white flowers, has very long pedicels like *D. pedicellaris*. *D. nitidula* subsp. *allantostigma* is easily distinguished from *D. pedicellaris* by its pedicels being pendulous in fruit and by its red reniform stigmas.

Notes. The beige soils at the two distant locations of *Drosera pedicellaris* are similar, supporting similar vegetation. Exploration of many other soil types, such as yellow sand, white silica sand, laterite soils and clayey white sands along the roadsides and tracks in an area c. 15 km long and wide around the type location failed to reveal the presence of further populations of *D. pedicellaris*. It was only when the typical beige soils of the type location were encountered again that the second location for this species was found. Specificity of soil type has been observed for a majority of the pygmy *Drosera* taxa.

Fortunately a sizable area of natural vegetation presently exists between the two known populations of *Drosera pedicellaris*. It is therefore possible that more of the typical beige sand habitats apparently preferred by *D. pedicellaris* may be found in other areas off the many other roads and tracks in this region that have yet to be explored.

Acknowledgements

I would like to thank Paul Wilson for his assistance with the Latin diagnosis; Barbara Rye for her comments, and the staff of the Western Australian Herbarium.

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Eucalyptus calyerup (Myrtaceae), a new species of possible hybrid origin from south-western Australia

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Abstract

McQuoid, N.K. and Hopper, S.D. *Eucalyptus calyerup* (Myrtaceae) a new species of possible hybrid origin from south-western Australia. *Nuytsia* 15(1): 63–68 (2002). *Eucalyptus calyerup* McQuoid & Hopper is described and illustrated. It appears to be of possible hybrid origin, but morphologically stable, with the putative parents being *Eucalyptus occidentalis* Endl. and *E. platypus* Hook. subsp. *platypus*. It is endemic to the Calyerup Rocks area near Jerramungup in Western Australia and has aroused much interest from landcare groups. It is rare in the wild and in need of monitoring.

Introduction

By early 1994 approximately 133 putative *Eucalyptus* hybrids were included in the collection of the Western Australian Herbarium (Hopper 1995). More have been added since then, including the subject of this paper. Few of the putative hybrids have been critically investigated to determine their status by, for example, documenting segregation of parental characters under greenhouse conditions (e.g. Beard 1974), documenting partial sterility and indiscriminate pollinators (e.g. Hopper *et al.* 1978), and applying DNA fingerprinting to test for additive genetic inheritance (Rosetto *et al.* 1997).

Eucalyptus occidentalis Endl. and *E. platypus* Hook. subsp. *platypus* often hybridise when they grow together, usually producing a few first generation hybrids with low fertility and intermediate characteristics in their fruits, buds, leaves, seeds, stature and bark. The taxon described here as *E. calyerup* resembles these hybrids in morphology but differs by occurring as a discrete population of many hundreds of plants and displaying high fertility and uniformity in seed, seedling and adult leaf morphology. Evidence supporting this uniformity is from some 67,000 seedlings that have been grown and planted for landcare works in the Jerramungup district, showing very little variation.

The morphological uniformity of *E. calyerup*, together with its growing importance in landcare, commends recognising it as a new species. Its status as a possible hybrid needs further investigation. It appears to be the product of an old hybridisation event because no *E. platypus* subsp. *platypus* occurs near either of its known populations, yet *E. calyerup* exists as a uniform group interspersed with *E. occidentalis*. Backcrossing with *E. occidentalis* may be occurring and further work is required to ascertain this.

Description

***Eucalyptus calyerup* McQuoid & Hopper, sp. nov.**

A *Eucalypto occidentali* Endl. cortice laxe aspero in parte inferiore trunci, foliis brevioribus crassioribusque, et pedicellis pedunculisque brevioribus crassioribusque differt.

Typus: south of Calyerup Rocks, 200 m south-west of old miners camp, 33°57'S, 119°05'E, Western Australia, 1 September 2002, *N.K. McQuoid* 575 (*holo*: PERTH; *iso*: ALB, CANB, PERTH).

Tree erect, to 10 m tall, without or rarely with a lignotuber. Bark in a short finely rough and dark grey stocking 100–700 mm long, decorticating and pale smooth matt cream to pale pink above stocking. *Pith glands* present. *Seedling leaves* alternate, ovate, 55–65 mm long, 36–42 mm wide, dull, blue-green. *Adult leaves* petiolate, alternate, obovate to elliptic-lanceolate, 45–77 mm long, 15–36 mm wide, glossy, pale green, veins prominent, reticulation sparse. *Inflorescences* axillary, unbranched, erect, 7-flowered; peduncle slightly down-curved, flattened and broad, 25–35 mm long. *Buds* shortly pedicellate, erect to curved down, elongated, 25–33 mm long, 6–8 mm wide, scar noticeable, operculum narrower than hypanthium, stamens erect. *Flowers* creamy yellow. *Fruit* shortly pedicellate, erect or sometimes curved down, very slightly campanulate, noticeably two-winged, 14–17 x 9–12 mm, rim thick, disc level to descending; valves 4, slightly exserted. *Seeds* dark brown, compressed ovoid, with distinct reticulum, 1.3–1.5 mm long, 0.8–1.0 mm wide, 0.7–0.8 mm thick (Figure 1)

Other specimens examined. WESTERN AUSTRALIA: Calyerup Rocks, 20 km E of Jerramungup, 6 Nov. 2000, *N.K. McQuoid* 561 (PERTH); S of Calyerup Rocks, at old miners camp, 33°57'S, 119°05'E, 4 May 2002, *N.K. McQuoid* 573 (ALB, PERTH); W of Calyerup Rocks, 300 m S of Old Ongerup Track, 33°55'S, 119°05'E, 1 Sep. 2002, *N.K. McQuoid* 576 (ALB, CANB, PERTH); S of Calyerup Rocks, at old miners camp, 33°57'S, 119°05'E, 5 Oct. 2002, *N.K. McQuoid* 577 (ALB, CANB, PERTH).

Distribution and habitat. Known only from around granite rocks near Calyerup Rocks, 20 km east of Jerramungup in south west of Western Australia. It co-dominates woodland with *Eucalyptus occidentalis* and *Allocasuarina huegeliana*. Soil is pale brown sandy loam. Calyerup Creek drains to the south to the west of the area. (Figure 2)

Flowering period. October to December.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Two known populations, the main population where there are at least several hundred plants in close proximity, the other population extending two kilometres northwards and comprising widely scattered individuals. Current tenure is unallocated Crown land over which mining exploration leases occur. However, the location of *E. calyerup* is away from the minerals subject to exploration activity. The area also supports the endangered dasyurid marsupial *Phascogale calura* adding to its conservation need. Fire regimes where burn frequency intervals are less than 15 to 20 years could also impact the conservation of this obligate seeder taxon. Further searches may find it located nearby.

Etymology. The specific epithet refers to the Nyoongar Aboriginal name for the granite rock area that it comes from – Calyerup Rocks. Calyerup Rocks are a place of significant cultural and spiritual interest to Nyoongar people as well as heritage interest to the wider community.

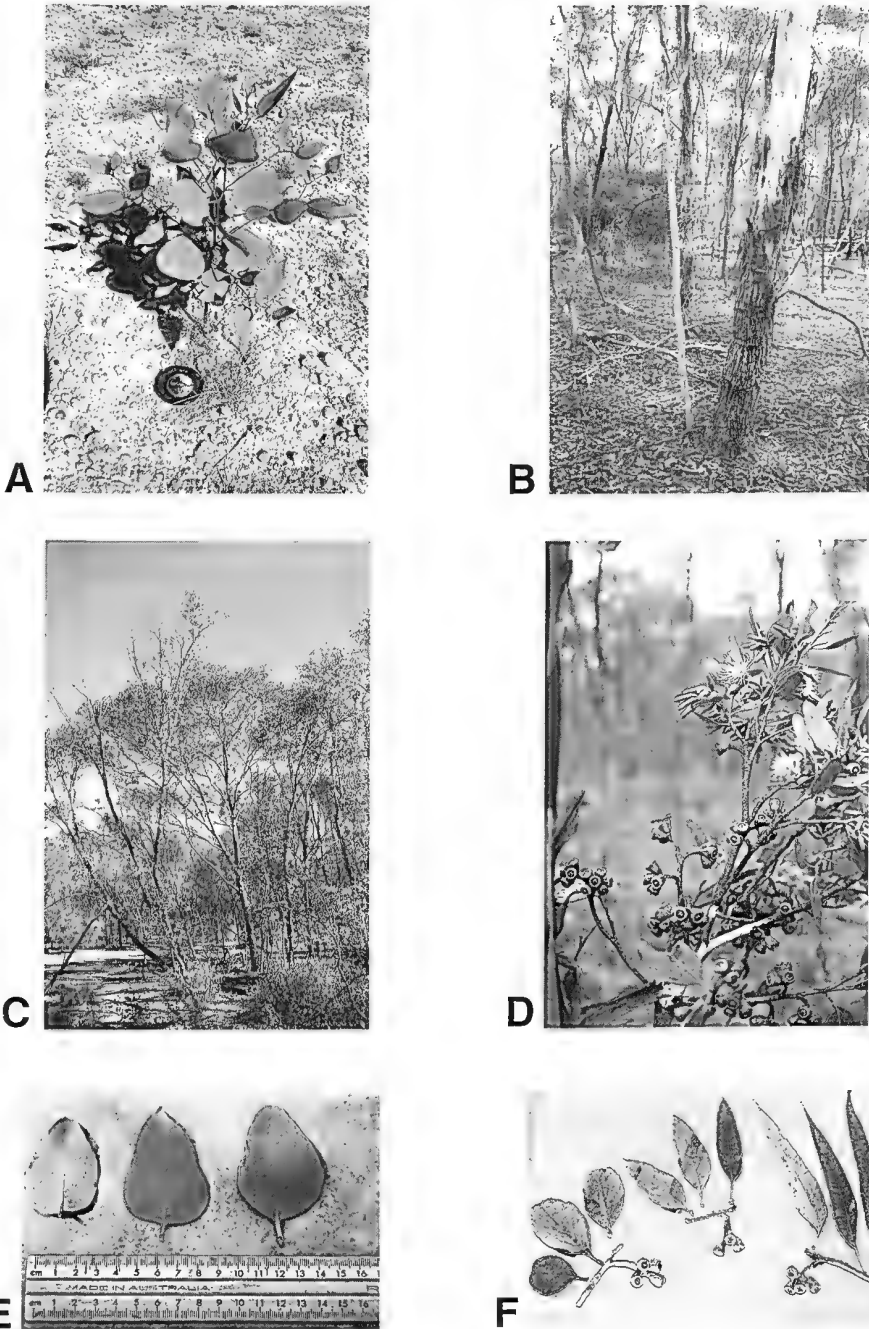


Figure 1. *Eucalyptus calyerup*. A – eight month old planted seedling; B – tree at Calyerup Rocks, showing short loose stocking and smooth trunk; C – tree at Calyerup Rocks northern population, showing form and comparison to surrounding *E. occidentalis*; D – buds and fruits; E – three typical seedling leaves; F – selection of adult leaves and mature fruits showing intermediate characteristics of *E. calyerup* (middle), compared with *E. occidentalis* (right) and *E. platypus* subsp. *platypus* (left).

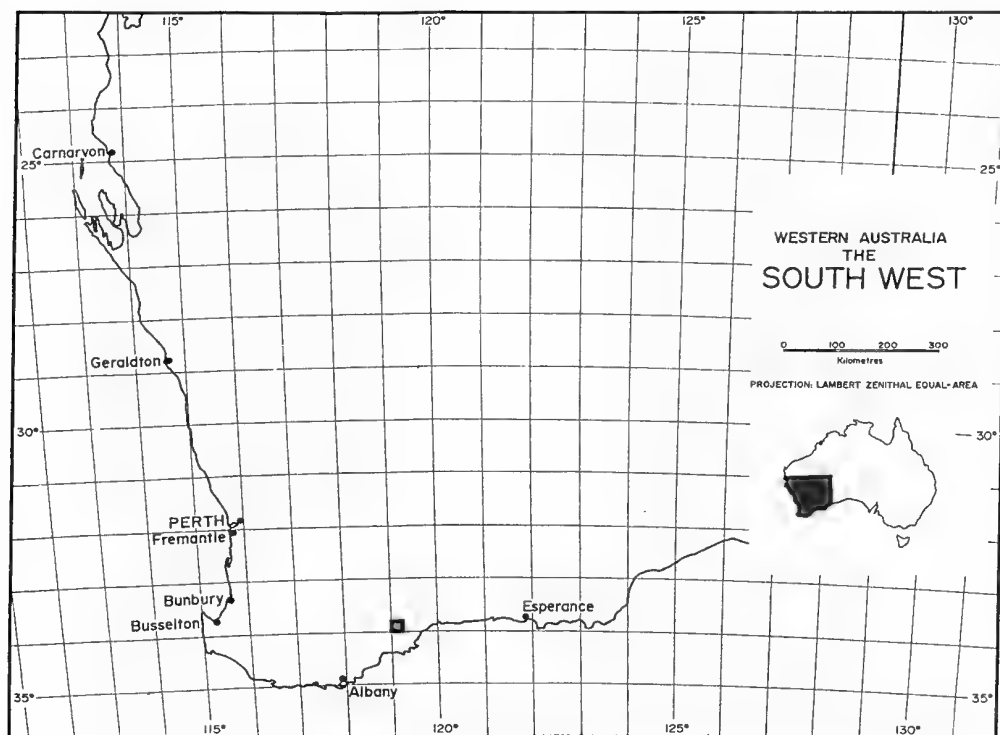


Figure 2. Distribution map for *Eucalyptus calyerup*.

Notes. This taxon differs from one of its putative parents, *Eucalyptus occidentalis*, in its shorter stocking of looser bark, its shorter and thicker leaves, its shorter and stouter pedicels and peduncles, and its less campanulate fruits. From the other putative parent, *E. platypus* subsp. *platypus*, it differs in having a stocking of rough bark, its longer and thinner leaves, its longer and finer pedicels and peduncles, and its very slightly campanulate fruits. Table 1 outlines the differences between the three taxa and Figure 1F shows a visual comparison of their leaves and fruits.

Eucalyptus calyerup has been grown extensively (35,000 in 2000, 20,000 in 2001 and 12,500 in 2002) in the Jerramungup district as a popular local tree that exhibits resistance to lerp attack. The seedlings are thriving thus far, often out-performing other eucalypts. This wide use has assisted its conservation status. It is also undergoing scrutiny as a possible farm forestry subject for its straight, tall and fast growth, and potential timber quality.

Acknowledgements

We thank: Dr Ian Brooker for comments on the draft and providing the Latin description, Mr Brendan Lepschi of CSIRO Canberra for his assistance and discussion in developing this treatment, Ms Carolyn Daniel, Mr Geoff Bee, Mr Lawrie Walter, Mr David Lullfitz and other members of the Jerramungup Landcare Conservation District Committee and Fitzgerald Catchment Group for assistance in realising the potential of *E. calyerup* as a landcare species, and the Commonwealth Government Natural Heritage Trust Bushcare Program for the funding assistance that enabled the discovery and cultivation of this new taxon.

Table 1. A comparison of *Eucalyptus calyerup*, *E. occidentalis* and *E. platypus* subsp. *platypus* using nine groups of morphological characters.

	<i>Eucalyptus calyerup</i>	<i>E. occidentalis</i>	<i>E. platypus</i> subsp. <i>platypus</i>
habit	mallet.	tree.	marlock.
bark stocking	loosely rough, short, on lower trunk only.	densely rough, long, sometimes extending to lower branches.	absent.
seedling leaves	55–65 x 36–42 mm, blue-green.	60–140 x 30–70 mm, blue-green.	to 70 mm x 40 mm, green, scabrid.
adult leaves	obovate to elliptic-lanceolate, 45–77 mm x 15–36 mm, pale green, veins prominent, reticulation sparse.	lanceolate, 60–160 mm x 10–33 mm, green, veins prominent, reticulation moderate to sparse.	obovate to orbicular, 25–75 x 18–35 mm, olive green to green, veins not prominent apart from midrib, reticulation very sparse, obscured by very numerous, round, island oil glands.
inflorescences	7-flowered; peduncle slightly down-curved, 25–35 mm long.	7(9)-flowered; peduncle down-curved, 10–40 mm long.	7-flowered; peduncle erect or down-curved, 22–60 mm long.
buds	shortly pedicellate, 25–33 x 6–8 mm, scar noticeable, hypanthium slightly 2-winged.	pedicellate, 16–33 x 5–7 mm, scar obscure, hypanthium smooth to slightly wrinkled.	sessile to shortly pedicellate, 20–30 x 6–9 mm, scar present, hypanthium often 2-winged.
flowers	creamy yellow, October to January.	creamy white, November to May.	pale yellow, September to January.
fruit	shortly pedicellate, barrel-shaped to very slightly campanulate, 14–17 x 9–12 mm, disc level to descending; valves 4, slightly exserted.	pedicellate, campanulate, 8–15 x 6–12 mm, disc level to descending, valves, 4, exserted.	sessile, obconical to barrel-shaped, 10–18 x 10–14 mm, disc level to descending, valves 4(5), level or exserted.
seed	dark brown, compressed ovoid, with distinct reticulum.	brown, compressed-ovoid with shallow distinct reticulum.	grey-black, compressed-ovoid with distinct reticulum.

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A revision of *Eucalyptus* series *Callicolae* (Myrtaceae) from the south coast of Western Australia

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Abstract

Nicolle, D. A revision of *Eucalyptus* series *Callicolae* (Myrtaceae) from the south coast of Western Australia. *Nuytsia* 15(1): 69–76 (2002). *Eucalyptus* series *Callicolae* Brooker consists of four closely related taxa, two of which are newly described. *E. callicola* Brooker subsp. *callicola* is restricted to the Hamelin Bay area on the Leeuwin Coast, and subsp. *unita* Nicolle subsp. nov. occurs in scattered populations from west of Denmark eastwards towards Bremer Bay. *E. ligulata* Brooker subsp. *ligulata* occurs from Cape Le Grand to Cape Arid, and subsp. *stirlingica* Nicolle subsp. nov. is restricted to the Stirling Range. A key and distribution map for the taxa of *Eucalyptus* ser. *Callicolae* are presented.

Introduction

Brooker (1974) described six new species of *Eucalyptus* L'Her. subgenus *Eucalyptus* from southern Western Australia, including *E. callicola* and *E. ligulata*. At that time, *E. callicola* was known from only a single population and *E. ligulata* from two widely disjunct localities. Although the two species are regarded as closely related and more distantly related to other taxa of *E. subg. Eucalyptus*, it was not until recently (Brooker 2000) that the two were placed together in *E. series Callicolae*. Over the last 25 years, many more populations have been discovered that have been variously included in either of these two species and it has become apparent that some of these populations represent distinct taxa that are recognisable on morphological features and occupy non-overlapping geographical areas. This paper presents a taxonomic revision of *Eucalyptus* series *Callicolae*, including the description of two new subspecies.

Taxonomy

Eucalyptus* series *Callicolae Brooker, *Aust. Syst. Bot.* 13: 132 (2000). Type: *Eucalyptus callicola* Brooker.

The classification and distinguishing features of *E. ser. Callicolae* within *Eucalyptus* are as follows (amended from Brooker 2000).

Eucalyptus subg. *Eucalyptus* (the 'monocalypts') – cotyledons reniform; pith of branchlets lacking oil

glands; inflorescences simple, axillary; buds asepalous, uni-operculate.

Eucalyptus sect. *Longistylus* Brooker – all stamens fertile; style long.

Eucalyptus subsect. *Frutices* Brooker – mallees; juvenile leaves opposite; adult leaves concolorous; anthers ovoid, opening by non-confluent slits.

Eucalyptus ser. *Callicolae* – bark \pm smooth and annually decorticating; juvenile leaves sessile; inflorescences 7–19-flowered, held erect; buds ribbed; flowers white; seeds black.

A series of four closely related allopatric taxa distributed in coastal and subcoastal southern Western Australia (Figure 1).

Key to taxa of *Eucalyptus* ser. *Callicolae*

1. Adult leaves glossy, bright green; juvenile leaves highly glossy, light green; soil limestone-derived
 2. Fruit 12–16 mm diam., strongly ribbed, 4-locular **1a. *E. calcicola* subsp. *calcicola***
 2. Fruit 10–12 mm diam., smooth to weakly ribbed, 3(4)-locular .. **1b. *E. calcicola* subsp. *unita***
1. Adult leaves \pm glossy, blue-green; juvenile leaves dull to glossy, green to blue-green; soil granite or sandstone-derived
 3. Fruit disc descending to level, operculum conical, equal in length to hypanthium, pedicels 4–8 mm long **2a. *E. ligulata* subsp. *ligulata***
 3. Fruit disc level to ascending, operculum long conical, much longer than hypanthium, pedicels 2–3 mm long **2b. *E. ligulata* subsp. *stirlingica***

1. *Eucalyptus calcicola* Brooker, *Nuytsia* 1(4): 302 (1974). *Type*: near Cape Freycinet, 34°07'S, 115°00'E, Western Australia, 18 June 1971, K.M. Allan 634 (*holo*: PERTH; *iso*: AD, BRI, CANB, GAUBA, HO, K, MEL, NSW).

Distribution. Distributed in coastal sites from Cape Freycinet eastwards to near Bremer Bay.

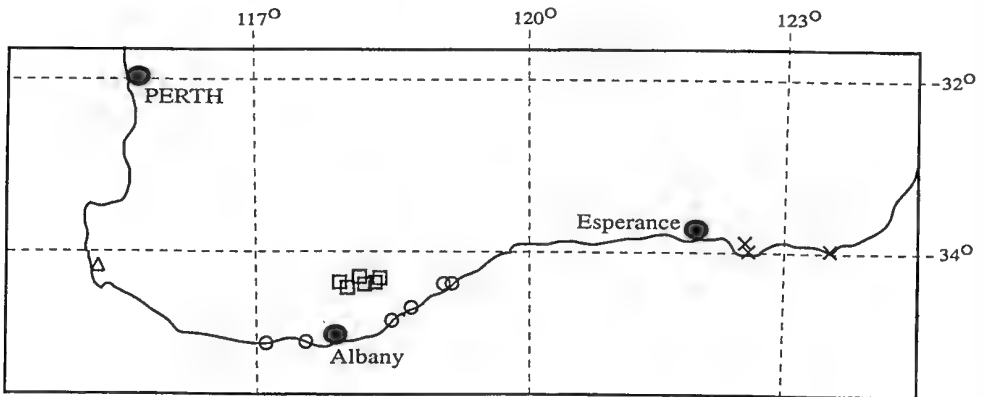


Figure 1. Map of the far southern part of Western Australia showing distribution of *Eucalyptus calcicola* subsp. *calcicola* Δ , *E. calcicola* subsp. *unita* \circ , *E. ligulata* subsp. *ligulata* \times and *E. ligulata* subsp. *stirlingica* \square .

Notes. Two geographically separated subspecies can be recognised on the basis of adult morphology, differing primarily in flower bud and fruit size and ornamentation.

1a. *Eucalyptus callicola* Brooker subsp. *callicola*

Seedling and juvenile leaves glossy, bright green. *Adult leaves* lanceolate and \pm falcate, 60–110 mm long, 14–25 mm wide. *Inflorescences* 7–13-flowered. *Buds* strongly ribbed, 12–14 mm long, 7–8 mm wide; operculum conical, strongly ribbed. *Fruits* strongly ribbed, 12–14 mm long, 12–16 mm diam., 4-locular (4-valved). (Figure 2A)

Specimens examined. WESTERN AUSTRALIA: 23.2 km SW of Margaret River, 24 Sep. 1978, J.D. Briggs 297, 298 (CANB, PERTH); near Hamelin Bay, 8 May 1972, M.I.H. Brooker 3698 (CANB, PERTH); Boranup Beach Road, track to Rocky Point, 16 Nov. 1981, M.I.H. Brooker 7199 (CANB, PERTH); track W of Hooley Road, Boranup area, 24 Mar. 1983, M.I.H. Brooker 8054, 8055 (CANB, PERTH); halfway between Boranup and Cape Freycinet, 1971, W.H. Butler s.n. (CANB, PERTH); directly W of Boranup Karri Forest, Boranup, 30 Jan. 1973, P. Christensen 650 (PERTH); N side of Hooley Road, c. 1 km from beach, Leeuwin–Naturaliste National Park, 28 Nov. 1989, N. Gibson & M. Lyons 253 (PERTH); 25 km N of Augusta, 18 km S of Margaret River, 11.5 km W of Caves Rd on Hooley Rd, 9 Oct. 1984, S.D. Hopper 4295 (PERTH); near Boranup Hill, N of Hamelin Bay, 34°09'31"S, 115°02'27"E, 27 Jan. 1996, D. Nicolle 1674 & M. French (AD); Davies Rd to Quinns Rocks, Hamelin Bay, 22 May 1982, C.J. Robinson 4799 (PERTH).

Distribution and habitat. Known from a few stands between Cape Freycinet and Cape Hamelin, growing on large coastal dunes of shallow sand over limestone. *E. callicola* subsp. *callicola* is sometimes associated with *E. megacarpa*, with a putative hybrid between the two taxa known (M.W. McDonald 1317, CANB).

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although *E. callicola* subsp. *callicola* is of very restricted distribution, all populations are conserved within Leeuwin–Naturaliste National Park and is considered secure.

Notes. With the description of subsp. *unita* below, the typical subspecies of *E. callicola* is now restricted to the Leeuwin coast. *E. callicola* subsp. *callicola* has larger, more prominently ribbed buds and fruits than the other taxa in the series and has some horticultural potential in difficult, coastal situations on limestone.

1b. *Eucalyptus callicola* subsp. *unita* Nicolle, subsp. nov.

Affinis *Eucalypto ligulatae* sed characteribus sequentibus distinguitur: foliis juvenilibus nitidibus, viridibus; foliis adultis nitidibus, viridibus; operculis brevioribus, minus conicis; habitatione calcareo differt. Affinis subspecie typica characteribus sequentibus distinguitur: alabastris minoribus, minus costatis, operculis rotundatis vel conicis, fructibus minoribus, laevibus vel leviter costatis, plerumque 3-locularibus differt.

Typus: Point Hillier, WSW of Denmark, 35°04'S, 117°09'E, Western Australia, 28 January 2001, D. Nicolle 3757 & M. French (*holo:* PERTH; *iso:* AD, CANB, MEL, NSW).

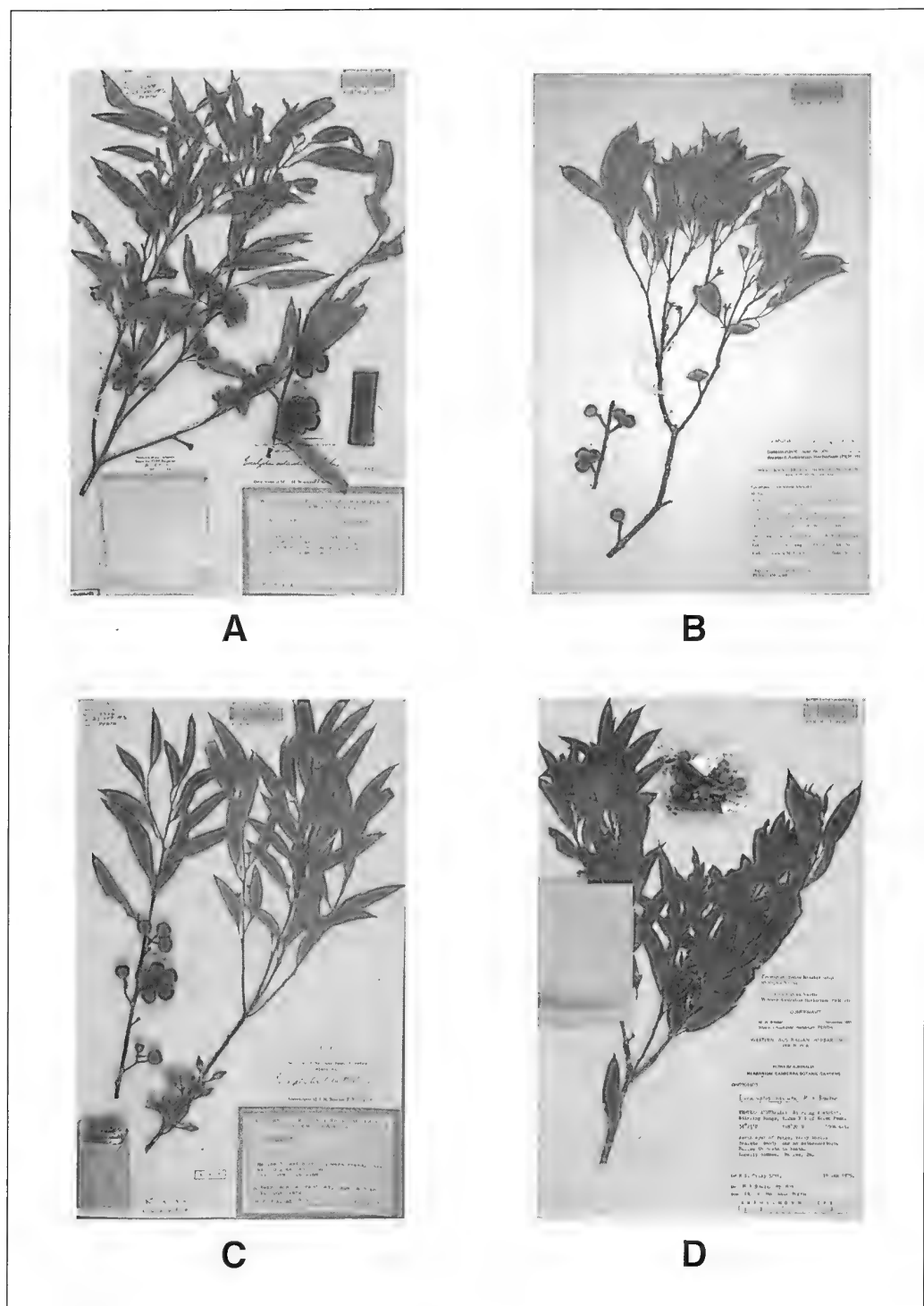


Figure 2. Holotypes. A – *Eucalyptus calcicola* subsp. *calcicola*; B – *E. calcicola* subsp. *unita*; C – *E. ligulata* subsp. *ligulata*; D – *E. ligulata* subsp. *stirlingica*.

Mallee, 1–8 m tall, crown dense. *Lignotuber* present. *Bark* smooth throughout, \pm dull, grey over light grey, tan or slightly green-yellow, decorticating in strips. *Branchlets* not glaucous, pith glands absent. *Cotyledons* reniform. *Seedling leaves* opposite, sessile, ovate, discolorous, glossy above, bright green, to 50 mm long and 30 mm wide; seedling stems terete, smooth or sparingly hairy. *Adult leaves* disjunct, petiolate, lanceolate to broad-lanceolate and often \pm falcate, 45–115 mm long, 12–25 mm wide, concolorous, glossy, light green or yellow-green, reticulation broken, oil glands apparently absent. *Inflorescences* axillary, singular, 7–13(19)-flowered, peduncles 7–15 mm long, pedicels 3–5 mm long. *Buds* 8–11 mm long, 5–7 mm wide, operculum weakly ribbed, flattened-hemispherical to conical, 4–5 mm long. *Flowers* white. *Fruit* cupular to truncate-globose, smooth to weakly ribbed, 9–11 mm long, 10–12 mm wide; operculum scar slightly ascending, to 1 mm wide; disc more or less level, 1–2.5 mm wide, valves 3, rarely 4, enclosed. *Seeds* boat-shaped, glossy, dark brown to black, 2–3 mm long, slightly flanged, ventral side \pm smooth, dorsal side finely reticulate. (Figure 2B)

Specimens examined. WESTERN AUSTRALIA: 800 m W of lookout along walk trail, 20 m N of track, West Cape Howe National Park, 19 Feb. 1993, A. Annels 3138 (PERTH); 1.9 km from Bremer Bay road on track 11.7 km W of Swamp road, 9 March 1988, M.I.H. Brooker 9921 (PERTH); N of Warramurrup Hill, 9 Mar. 1988, M.I.H. Brooker 9922 (PERTH); West Cape Howe, on ridge, c. 500 m W of lookout, 29 Oct. 1988, L. Johnson 9149 (AD, BRI, CANB, NSW, PERTH); West Cape Howe, Bruce Tarbottom Memorial Walk, on ridge crest, 5 Sep. 1988, K. Hill 3076 (AD, CANB, MEL, NSW, PERTH); 1.8 km S of Bremer Bay Rd on Reef Beach Rd [actually Warramurrup Rd], 6 Oct. 1984, S.D. Hopper 4234 (PERTH); Shelly Beach, West Cape Howe, hill above beach, 29 Dec. 1986, G.J. Keighery 10001 (PERTH); Pallinup River Estuary, 5 Aug. 1971, A. Kessel 961 (PERTH); “Barry’s place”, near Hauloff Rocks, 8 Oct. 1996, D. Nicolle 1878 (CANB, PERTH); 4.1 km N of West Cape Howe, 28 Jan. 1988, A. Napier & A. Taylor 212, 213, 214 (CANB, NSW, PERTH); Cape Riche, no date, K.R. Newbey (PERTH); 3 miles [5 km] NW of Hauloff Rock, 50 miles [80 km] NE of Albany, 29 Jan. 1973, K.R. Newbey s.n. (PERTH); West Cape Howe National Park, 35°06’22”S, 117°37’51”E, 27 Jan. 1996, D. Nicolle 1669 (AD, CANB, PERTH); near Warriup Hill 34°42’14”S, 118°33’19”E, 27 Jan. 2001, D. Nicolle 3753 & M. French (AD, CANB, PERTH); Point Hillier, WSW of Denmark, 35°03’43”S, 117°09’09”E, 28 Jan. 2001, D. Nicolle 3758 & M. French (AD, CANB, NSW, PERTH); 1.8 km from Bremer Bay Rd on Warramurrup Rd, 34°24’50”S, 119°10’08”E, 21 July 2001, D. Nicolle 3978 & M. French (CANB, PERTH); 11.1 km from Bremer Bay Rd on Warramurrup Rd, 34°27’59”S, 119°08’50”E, 21 July 2001, D. Nicolle 3979, 3980 & M. French (CANB, PERTH); West Cape Howe National park, walk track ridge line near summit from Shelley Beach, 21 Dec. 1992, C.J. Robinson 1067 (PERTH); Hauloff Rock area, Cape Riche, 7 Feb. 1991, C.J. Robinson & L. Anderson s.n. (ALB, PERTH); near southern tip of Cape (Point) Hillier, west end of William Bay, west of Denmark, 35°03’40”S, 117°08’50”E, 22 Apr. 1989, A. Syme 89-1 & 89-2, S.G. Webster & A.S. Weston (PERTH).

Distribution and habitat. *Eucalyptus calcicola* subsp. *unita* is known from scattered populations from Point Hillier, west-south-west of Denmark, to Warramurrup Hill, west of Bremer Bay. All populations occur on coastal headlands or large limestone dunes. Soils are grey sandy loams or sand overlying limestone. It occurs as an emergent in dense, low coastal shrubland, often dominated by *Agonis flexuosa* and *Acacia*, *Melaleuca* and *Dryandra* species. It sometimes occurs with other scattered mallee species such as *Eucalyptus grossifolia* sens. lat., *E. x missilis*, *E. decipiens* subsp. *adesmophloia*, *E. pleurocarpa* and *E. goniantha* subsp. *notactites*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Populations are scattered and variable in size. All known populations consist of less than several hundred individuals, except the populations near Hauloff Rocks and at Warramurrup Hill, where the populations are much larger, although not accurately surveyed. The subspecies is conserved in West Cape Howe National Park.

Etymology. From the Latin *unitus* (join together) referring to this species linking *E. calcicola* subsp. *calcicola* and *E. ligulata*, both geographically and morphologically.

Notes. This taxon has previously been known as *Eucalyptus* sp. West Cape Howe (G.J. Keighery 10001), *E. telenotia* Nicolle ms. and *E. unita* Nicolle ms. It is distinguished from *Eucalyptus calcicola* subsp. *calcicola* by the smaller, less ribbed buds often with a rounded to conical operculum and the smaller, smooth to weakly ribbed, usually 3-locular fruits.

Eucalyptus calcicola subsp. *unita* has previously been confused with *E. ligulata* (Brooker 1974; Brooker & Kleinig 1990; Kelly *et al.* 1990), because its relatively small, shallowly ribbed buds and fruits somewhat resemble those of *E. ligulata*. The glossy, light green juvenile and adult leaves, and limestone habitat of *E. calcicola* subsp. *unita* distinguish it from *E. ligulata* and indicate a closer relationship to *E. calcicola* subsp. *calcicola*. Briggs & Leigh (1995) included this taxon (populations from West Cape Howe) in both *E. calcicola* and as an unnamed species (*Eucalyptus* sp. 54).

Populations from west of Albany consistently possess a flattened-hemispherical operculum, while most specimens collected east of Albany have a conical operculum. At Warramurrup Hill (near Bremer Bay), individuals with opercula varying in shape from hemispherical to conical can be found.

2. *Eucalyptus ligulata* Brooker, Nuytsia 1(4): 300 (1974). *Type:* about 1.5 miles [2.4 km] east of the beach near Cape Le Grand, 33°58'S, 122°90[sic]'E, Western Australia, 15 March 1972, K.M. Allan 820 (*holo:* PERTH; *iso:* FRI, K, NSW).

Distribution. Distributed north of Albany in the Stirling Range and east of Esperance, at Cape Le Grand and Cape Arid.

Notes. Two geographically separated subspecies can be recognised on the basis of adult morphology, differing primarily in the adult leaf, flower buds and fruit size, flower bud structure and orientation of the fruit disc.

2a. *Eucalyptus ligulata* Brooker subsp. *ligulata*

Adult leaves 60–75 mm long, 14–16 mm wide. *Peduncles* 10–17 mm long. *Pedicels* 4–8 mm long. *Buds* 10–14 mm long, 4–5 mm diam.; operculum conical, smooth to very slightly ribbed, 5–7 mm long. *Fruit* pyriform-ovoid to barrel-shaped, smooth to weakly ribbed, 10–14 mm long, 9–13 mm wide; operculum scar ascending, < 1 mm wide, disc level to descending, 1–2.5 mm wide, valves 3. (Figure 2C)

WESTERN AUSTRALIA: near Cape Le Grand Bay, Cape Le Grand National Park, 15 March 1972, K.M. Allan 822 (CANB, PERTH); S of Frenchmans Peak, Cape Le Grand National Park, 22 June 1978, D.F. Blaxell 1682 (PERTH); Lucky Bay, Cape Le Grand National Park, 22 June 1978, D.F. Blaxell 1683 (PERTH); Lucky Bay, Cape Le Grand National Park, 6 Nov. 1987, D.F. Blaxell 86 & M.I.H. Brooker (PERTH); 2nd creek E of granite dome which is about 1 mile [1.6 km] from Cape Le Grand towards Esperance, 22 April 1972, M.I.H. Brooker 3609, 3610 (CANB, PERTH); W side of main entrance to Lucky Bay, 8 April 1974, M.I.H. Brooker 4474, 4475 (CANB, PERTH); foot of E side of Frenchmans Peak, near Cape Le Grand, 8 April 1974, M.I.H. Brooker 4476 (CANB, PERTH); Lucky Bay, 21 Jan. 1966, A.S. George 7478 (PERTH); Cape Le Grand National Park, c.1 km NE of Mt

Le Grand, 3 May 1982, *S.D. Hopper* 2274 (PERTH); Mt Arid, track to Thomas Fishery, Cape Arid, 17 June 1985, *G.J. Keighery* 7641 (PERTH); Mt Arid, Cape Arid, 30 Oct. 1989, *G.J. Keighery* 10875 (PERTH); western end of Thistle Cove, 15 Nov. 1987, *A. Napier* 156 (PERTH); 200 m S of waterfall N of Mt Le Grand, 33°49'15"S, 122°12'21"E, 8 Dec. 1992, *D. Nicolle* 175 (AD); E slope of Mt Arid, in saddle between summit and large dome to SE, 23 Nov. 1985, *A. Rodd* 5138 (PERTH); W end of Lucky Bay, Cape Le Grand National Park, 22 June 1967, *R.D. Royce* 8388 (PERTH); at N base of Mt Le Grand c. 200 m E of upper check dam, Cape Le Grand National Park, 5 Nov. 1971, *A.S. Weston* 7030 (CANB, PERTH); E of Lake, below Frenchmans Peak, Cape Le Grand National Park, 27 Nov. 1973, *A.S. Weston* 8964 (PERTH); Lucky Bay, near Cape Le Grand, 17 Jan. 1944, *H.M. Wilson* 76 (PERTH).

Distribution and habitat. Distributed east of Esperance where it is known from two disjunct localities, viz. Cape Le Grand and Cape Arid. It occurs on sands overlying granite near large coastal granite domes and peaks. Associated eucalypt species include *E. aquilina*, *E. doratoxylon*, *E. incrassata*, *E. lehmannii*, and *E. semiglobosa*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. All known populations are conserved within Cape Le Grand and Cape Arid National Parks. The subspecies is considered to be rare but not currently threatened.

2b. *Eucalyptus ligulata* subsp. *stirlingica* Nicolle, subsp. nov.

A subspecies typica pedicellis brevioribus, alabastris angustioribus, operculis longis, conicis, aliquando quam hypanthio multo longioribus; fructus disco planato vel elevato differt.

Typus: Stirling Range, 1.2 km north-north-east of Ellen Peak, Western Australia, 19 January 1979, *M.D. Crisp* 5291 (*holo:* PERTH; *iso:* CANB, K, MO, NSW).

Adult leaves 35–75 mm long, 7–18 mm wide. *Peduncles* 5–16 mm long. *Pedicels* 2–3 mm long. *Buds* 9–10 mm long, 3–4 mm diam.; operculum long-conical, smooth to very slightly ribbed, 5–7 mm long. *Fruit* globose to slightly cupular, smooth to very lightly ribbed, 6–10 mm long, 6–11 mm diam., operculum scar ascending, < 1 mm wide, disc level to ascending, 1–2.5 mm wide; valves 3. (Figure 2D)

Specimens examined. WESTERN AUSTRALIA: Mt Magog, Stirling Range, 6 Dec. 1994, *S. Barrett* 287 (PERTH); Ellen Peak, N slopes, 4 Oct. 1975, *J.S. Beard* 7655 (PERTH); road to Trio Peak, Stirling Range, 8 June 1969, *M.I.H. Brooker* 2325a (PERTH); Mt Trio car park, on track to hill, 14 Nov. 1981, *M.I.H. Brooker* 7183 (NSW, PERTH); S of Ellen Peak, Stirling Range, 7 Oct. 1982, *M.I.H. Brooker* 7705 (PERTH); half way up Mt Trio, N side, Stirling Range, 21 Mar. 1983, *M.I.H. Brooker* 8033 (PERTH); 15 miles [24 km] E of Red Gum Spring, Stirling Range, 17 Feb. 1969, *G.M. Chippendale* 434 (PERTH); Warrup Hill, Stirling Range, 28 April 1923, *C.A. Gardner s.n.* (PERTH); Stirling Range National Park, car park, Mt Trio road, 23 Mar. 1982, *S.D. Hopper* 2119 (PERTH); Stirling Range National Park, 4.5 km N along Success Ridge track from East Pillenorup track, 34°23'30" S, 118°10'50" E, 26 Mar. 1982, *S.D. Hopper* 2171 (PERTH); Stirling Range National Park, hill S of Yungemere, 5 May 1982, *S.D. Hopper* 2307 (PERTH); Stirling Range National Park, hill S of Yungemere, c. 0.8 km S of Yungemere Crescent fire trail, 5 May 1982, *S.D. Hopper* 2312 (PERTH); Bluff Knoll, 19 km ENE of Toolbrunup Peak, Stirling Range National Park, 6 May 1982, *S.D. Hopper* 2323 (PERTH); Stirling Range National Park, SE foothills, 7 May 1982, *S.D. Hopper* 2335 (PERTH); Stirling Range National Park, SE sector, foothills, 7 May 1982, *S.D. Hopper* 2337 (PERTH); Stirling Range National Park, c. 1 km N of summit of Wedge Hill, 9 May 1982, *S.D. Hopper* 2350 (PERTH);

summit of Wedge Hill, Stirling Range, 12 May 1982, *G.J. Keighery* 4880 (CANB, PERTH); base of Mt Talyuberup, Stirling Range, 14 May 1982, *G.J. Keighery* 4956 (CANB, PERTH); 50 m up walk track from Mt Trio car park, 10 Oct. 1987, *A. Napier & A. Taylor* 101 (ALB, PERTH); Mt Trio car park, Stirling Range National Park, 34°20'47"S, 118°06'38"E, 4 Nov. 2000, *D. Nicolle* 3560 & *M. French* (CANB, PERTH).

Distribution and habitat. Restricted to the Stirling Range, particularly the higher central and eastern part of the range, occurring on skeletal sandy loams overlying sandstones on the foothills, although also known to occur on the hills and ridges of the range itself. It occurs as a component of mallee shrubland, often associated with a number of other mallee species including *E. buprestium*, *E. decurva*, *E. falcata*, *E. hebetifolia* (syn. *E. medialis* and *E. xanthonema* subsp. *apposita*), *E. marginata* subsp. *marginata*, *E. megacarpa*, *E. preissiana* subsp. *preissiana* and *E. talyuberlup*.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although the total range of this subspecies is restricted, all the known populations occur within Stirling Range National Park and the subspecies is considered secure.

Etymology. The name is chosen because of the taxon's apparent restriction to the Stirling Range.

Notes. Distinguished from the typical subspecies by the shorter pedicels, the narrower buds with a long, conical operculum much longer than the hypanthium and the level to ascending disc of the fruit. Adult leaves, buds and fruits are also generally smaller in this subspecies.

Putative hybrids have been collected between *Eucalyptus ligulata* subsp. *stirlingica* and *E. buprestium*, *E. marginata* subsp. *marginata* and *E. preissiana* subsp. *preissiana*.

Acknowledgements

I wish to thank Malcolm French for field assistance and bringing to my attention some of the previously uncollected *Eucalyptus calcicola* subsp. *unita* populations. Steve Hopper provided information to locate the Bremer Bay population of *E. calcicola* subsp. *unita*. Ian Brooker is thanked for correcting the Latin diagnoses.

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Two new species of silver mallet (*Eucalyptus* – Myrtaceae) of very restricted distribution in south-western Western Australia.

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Abstract

Nicolle, D. Two new species of silver mallets (*Eucalyptus* – Myrtaceae) of very restricted distribution in south-western Western Australia. *Nuytsia* 15(1): 77–83 (2002). *Eucalyptus rugulata* Nicolle *sp. nov.* is described from the South Ironcap–Hatter Hill area north-east of Lake King, distinguished within the silver mallets by its broad and thick adult leaves and the large and robust buds and fruits. *E. purpurata* Nicolle *sp. nov.* is described from a single population near Bandalup Hill east of Ravensthorpe. It is distinguished from *E. argyphaea* L.A.S. Johnson & K.D. Hill by the conspicuous red-purple new growth and the smaller buds and fruits. Both new species are of restricted distribution and *E. purpurata*, in particular, is considered to be at risk. A key and distribution map for the silver mallets are presented.

Introduction

The two new species described here belong to *Eucalyptus* series *Falcatae* Brooker & Hopper. They were unknown or poorly known until recently, probably because of their limited natural distribution, and also, in the case of *E. rugulata*, because of a lack of knowledge regarding the application of the names *E. argyphaea*, *E. ornata* Crisp and *E. recta* L.A.S. Johnson & K.D. Hill. These five species are obligate seeders and together are known as the silver mallets.

Eucalyptus rugulata was first collected by Charles Gardner in 1929 at Hatter Hill. Gardner (1960) subsequently recognised the Hatter Hill population as a robust variant of *E. falcata* showing tendency towards *E. goniantha*. Gardner illustrated three forms of *E. falcata*, including his specimens from Hatter Hill which are representative of *E. rugulata*. All the silver mallets were included with *E. falcata* (a resprouter species) at the time of Gardner's treatment of *E. falcata*.

Eucalyptus purpurata is a much more recent discovery, first collected in 1994, despite its distinctive field appearance.

The two new species are published as a matter of priority because of their conservation status. Being obligate seeders they could be eliminated by frequent wildfire over their relatively small geographical range. They occur in areas undergoing extensive mining exploration and active mining, and populations of both species are under threat from such activities in the short term.

Taxonomy

The classification and distinguishing features of silver mallets within *Eucalyptus* are as follows (modified from Brooker 2000).

Eucalyptus subg. *Symphyomyrtus* (Schauer) Brooker – cotyledons folded in seeds; buds bi-operculate; seeds with ventral or terminal hilum; seed coat formed from both integuments.

Eucalyptus sect. *Bisectae* Maiden ex Brooker – cotyledons bisected; inflorescences axillary.

Eucalyptus subsect. *Destitutae* Brooker – pith of branchlets without glands.

Eucalyptus ser. *Falcatae* – mallees or mallets; leaf venation closely pinnate, tertiary venation finite; oil glands numerous, intersectional; inflorescences single in axils; inflexed staminal filaments with all anthers fertile; ovary roof not lobed.

Silver mallets – obligate seeders, lignotuber absent (mallets).

A group of five species restricted to the south-west of Western Australia as shown in Figure 1.

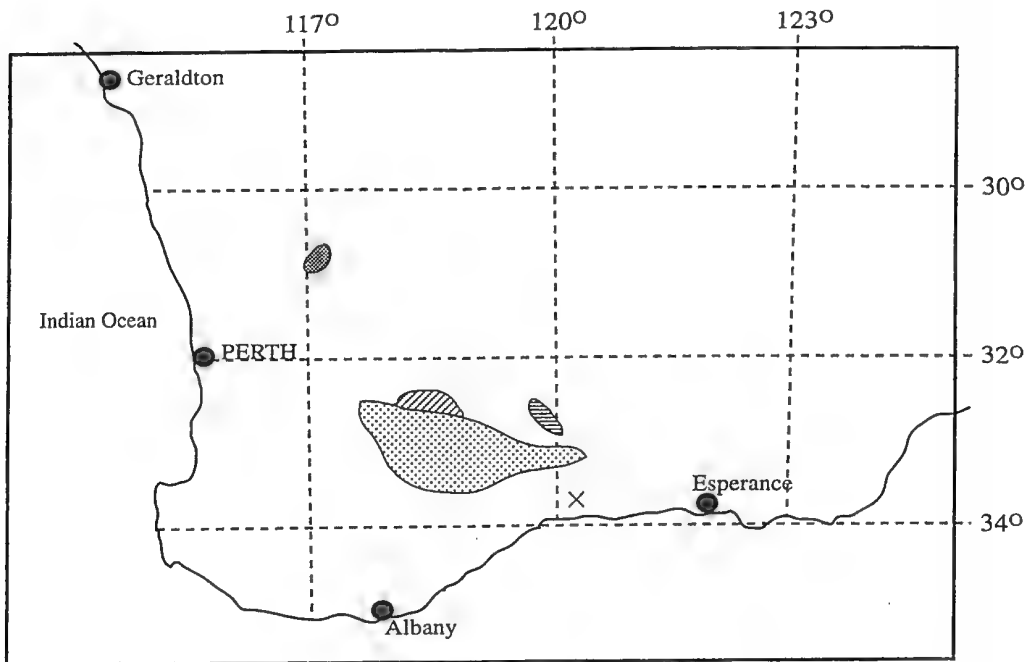


Figure 1. Map of the south-western part of Western Australia showing distribution of *Eucalyptus argyryphaea* ▩, *Eucalyptus ornata* ▨, *Eucalyptus purpurata* X, *Eucalyptus recta* ■, *Eucalyptus rugulata* ▤.

Key to the silver mallets of *Eucalyptus* ser. *Falcatae*

1. Buds (hypanthium and operculum) and fruits sharply ribbed longitudinally ***E. ornata***
1. Buds and fruits smooth to broadly or irregularly ribbed
 2. Fruit up to 8 mm diam., < 8 mm long; buds up to 7 mm wide
 3. Leaves, branchlets and buds yellow green to reddish-green, crown dark green; buds > 15 mm long, at least 5 mm wide ***E. argyphea***
 3. Leaves, branchlets and buds distinctly red-purple, crown purple-green; buds < 14 mm long, < 5 mm wide ***E. purpurata***
 2. Fruit > 8 mm diam., 8–11 mm long; buds at least 8 mm wide
 4. Fruit 8–9 mm long, broader than long; adult leaves 11–16 mm wide ***E. recta***
 4. Fruit 9–11 mm long, equal-dimensional or longer than broad; adult leaves 16–28 mm wide ***E. rugulata***

Eucalyptus rugulata* Nicolle, *sp. nov.

Affinis *Eucalypto rectae* sed foliis adultis latioribus et crassioribusque, fructibu longioribus, longioribus quam latioribus, cupulatis vel doliiformis et alabastris fructibusque irregulariter costatis distinguitur.

Typus: Digger Rocks, 3 km south of Varley turnoff on Forrestania road, 32°43'48"S, 119°49'12"E, Western Australia, 11 November 2000, D. Nicolle 3672 & M. French (*holo*: PERTH; *iso*: CANB).

Illustration. Gardner (1960: 6, Figures C–F).

Tree (mallet: obligate seeder) to 12 m tall. *Lignotuber* absent. *Bark* smooth throughout, fully decorticate in short longitudinal strips, somewhat glossy, dark grey to grey over silvery grey to pale tan-cream. *Branchlets* with pith glands absent. *Cotyledons* bisected. *Seedling leaves* initially ± opposite, shortly petiolate, linear; becoming disjunct, distinctly petiolate, broadly ovate to elliptical, slightly discoloured, dull, slightly blue-green, to 25 mm long and 15 mm wide. Seedling stem weakly square (TS) with scattered raised glands. *Adult leaves* disjunct; lanceolate to broad-lanceolate; concolorous, glossy to highly glossy, green to dark green; reticulation moderately dense to dense; oil glands sparse, island and intersectional; petiole 18–25 mm long, lamina 80–140 mm long, 16–28 mm wide. *Inflorescences* axillary, unbranched, 7–11-flowered; peduncles angular to flattened (TS), slightly distally broadened, 14–18 mm long; pedicels slightly angular (TS), 7–13 mm long. *Flower buds* pendulous, 15–20 mm long, 8–9 mm wide, hypanthium coarsely ribbed, cupular to cylindrical; operculum conical/horn-shaped, almost smooth to coarsely ribbed. *Flowers* cream to very pale creamy yellow; stamens inflexed, all fertile; anthers versatile, basifixed, opening by lateral slits. *Fruit* pendulous, tapering to pedicel, (truncate-globose to) cupular to barrel-shaped, 9–11 mm long, 8–11 mm wide, almost smooth to coarsely ribbed (ribs to 2 mm high). *Operculum scar* c. 2 mm wide, level to slightly ascending; staminophore prominent. *Disc* c. 2 mm wide vertically descending. *Valves* (3)4, exerted and fused at tips by persistent, fragile style remnants, breaking off to rim level with age. *Seeds* ovoid, slightly glossy, grey-brown, reticulation dense, 2–2.8 mm long. (Figure 2A)

Specimens examined. WESTERN AUSTRALIA: NE and at base of South Ironcap hill on Forrestania–Southern Cross road, 32°40'33"S, 119°46'41"E, 6 Nov. 1999, M. French 1085 (PERTH); Hatter's [Hatter] Hill, Nov. 1929, C.A. Gardner s.n. (PERTH); on northern side of gridline, c. 25 m NE of South Ironcap Trig, 32°40'46"S, 119°46'29"E, 7 Sep. 1996, N. Gibson & K. Brown 3142 (PERTH); NE of

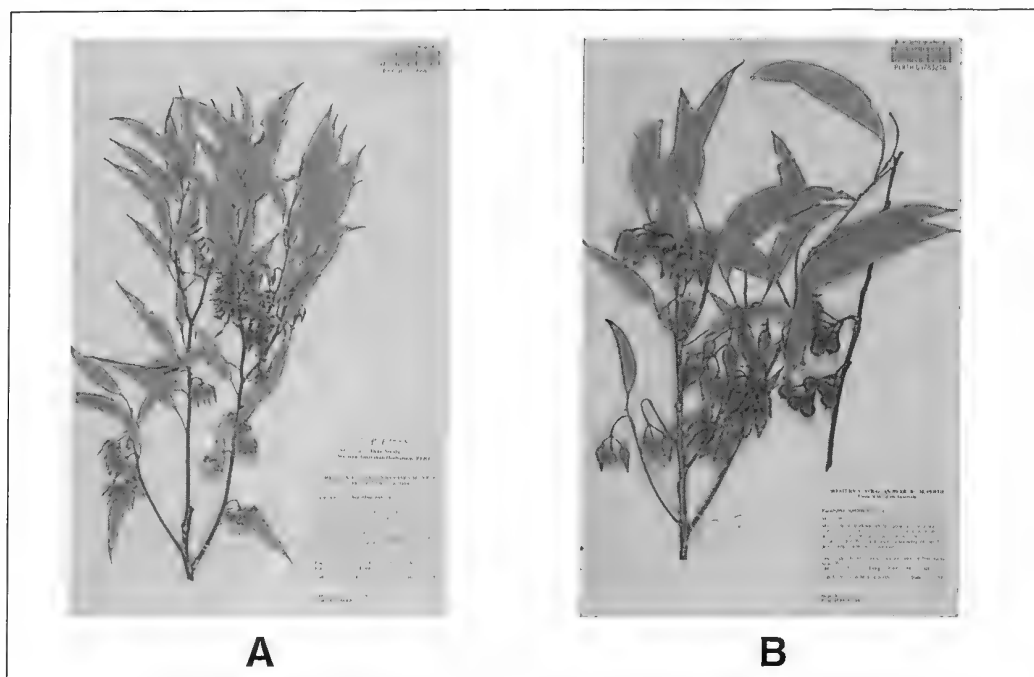


Figure 2. Holotypes. A – *Eucalyptus purpurata*; B – *E. rugulata*.

gridline junction, 70 m S of haul road around minesite, c. 800 m WSW of Digger Rocks, 32°43'52"S, 119°48'24"E, 6 Sep. 1996, *N. Gibson & K. Brown* 3143 (PERTH); in NE junction of gridlines, c. 1 km SW of South Ironcap, 32°41'14"S, 119°46'16"E, 8 Sep. 1996, *N. Gibson & K. Brown* 3184 (PERTH); 7.6 km E of RPF on Varley–Southern cross road, 1 Sep. 1988, *K. Hill* 3052 (CANB, NSW, PERTH); Hatter Hill area, c. 90–100 m NNE of Hatter Hill trig, 85 km N of Ravensthorpe, 32°49'44"S, 119°58'55"E, 26 May 1990 *H. Mollemans* 2710 (CANB, PERTH); c. 30 km S of Lake Cronin crossroads towards South Ironcap (eastern slope of South Ironcap) 32°40'45"S, 119°46'49"E, 11 Nov. 2000, *D. Nicolle* 3671 & *M. French* (AD, CANB, PERTH); summit of Hatter Hill, 32°49'39"S, 119°58'56"E, 11 Nov. 2000, *D. Nicolle* 3673 & *M. French* (AD, CANB, PERTH); South Ironcap, 3 Sep. 1970, *K.R. Newbey* 3290 (PERTH).

Distribution and habitat. Distributed from South Ironcap south to Hatter Hill, east of Varley (NNE of Lake King) in south-western Western Australia, over a linear range of approximately 26 kilometres. *E. rugulata* occurs on locally high hills consisting of orange lateritic gravel, often in more or less pure stands, but also associated with various other eucalypts such as *E. rigidula* Maiden, *E. livida* Brooker and Hopper, *E. densa* Brooker and Hopper subsp. *densa*, *E. phenax* Brooker and Slee subsp. *phenax* and *E. olivina* Brooker and Hopper.

Flowering period. Recorded in flower in November.

Conservation status. Conservation Codes for Western Australian Flora: Priority Four. Although the species is known from a restricted range, it is relatively common in locally higher and more rocky landscapes. Mining exploration in its area of occurrence indicates future mining activity may pose a

threat to the species. As the Hatter Hill area is poorly surveyed botanically, there is the possibility further populations may be found, increasing the species range.

Etymology. From the Latin *rugula* (wrinkle, corrugation) referring to the large fruits that become distinctly wrinkled upon drying (but are not sharply ribbed), and also referring to the broken, rugged sites in which the species grows in comparison to surrounding land forms.

Affinities. Closest to *Eucalyptus recta* L.A.S. Johnson & K.D. Hill, distinguished by the broader and thicker adult leaves; the more cupular to barrel-shaped, longer, equal-dimensional fruits (depressed-hemispherical, 8–9 mm long, and broader than long in *E. recta*) and the broadly and irregularly ribbed buds and fruits (\pm smooth in *E. recta*).

Notes. Hill & Johnson (1992) cited a specimen (Mollemans 2710), of what is here considered to be *E. rugulata*, as an intergrade between *E. ornata* and *E. argyphaea*. *Eucalyptus rugulata* has larger buds and fruits than either *E. ornata* or *E. argyphaea*, and occurs geographically to the north-east of both species, indicating the populations are not intergrades. Furthermore, *E. rugulata* forms large and morphologically consistent populations at its three known localities (viz. South Ironcap, Digger Rocks and Hatter Hill). *E. ornata* and *E. argyphaea* are known to intergrade in the area south and west of Hyden, and are the only two species of silver mallots known to naturally interbreed (e.g. 5.3 km N from Pingaring Varley road on Alymore Rd, 32°42'54"S, 118°53'04"E, 15 July 2001, D. Nicolle 3815 & M. French, PERTH).

Eucalyptus purpurata* Nicolle, *sp. nov.

Affinis *Eucalypto argyphaeae* sed foliis novis, ramulis alabastrisque puniceis et alabastris fructibusque minoribus distinguitur.

Typus: near Bandalup Hill, east of Ravensthorpe, 33°40'07"S, 120°24'03"E, Western Australia, 5 November 2000, D. Nicolle 3579 & M. French (*holo:* PERTH; *iso:* AD, CANB, NSW).

Tree (mallet: obligate seeder) to 10 m tall, with new growth (leaves, branchlets and buds) conspicuously red-purple. *Lignotuber* absent. *Bark* smooth throughout, fully decorticating in short longitudinal strips, dull, light grey over cream. *Branchlets* without pith glands, purple-red when new. *Seedling stems* slightly square (TS), with very scattered raised glands. *Cotyledons* bisected. *Juvenile leaves* initially opposite, shortly petiolate, linear; becoming disjunct, distinctly petiolate, elliptical, slightly discolourous, dull, slightly blue-green, to 28 mm long and 10 mm wide. *Adult leaves* disjunct; lanceolate; concolorous, glossy, maturing dark olive green; reticulation moderately dense; oil glands sparse, intersectional; petiole 13–17 mm long, lamina 45–95 mm long, 6–15 mm wide. *Inflorescences* axillary, unbranched, 7–11-flowered; peduncles terete to slightly angular (TS), 7–15 mm long; pedicels terete, 3–6 mm long. *Flower buds* pendulous, 11–13 mm long, 4–4.5 mm wide, hypanthium slightly ribbed; operculum conical/horn-shaped, smooth, slightly narrower to slightly broader than hypanthium at join. *Flowers* cream; stamens inflexed, all fertile; anthers versatile, basifixed, opening by lateral slits. *Fruit* pendulous, distinct from pedicel, truncate-globose to flattened-hemispherical, 5–6 mm long, 6–7 mm wide, \pm smooth (somewhat wrinkled when dry). *Operculum scar* < 1 mm wide, level. *Disc* c. 1 mm wide, vertically descending. *Valves* 3, exserted and fused at tips by persistent, fragile style remnants, breaking off to rim level with age. *Seeds* ovoid, 2–2.4 mm long, slightly glossy, grey-brown, reticulation fine. (Figure 2B)

Specimens examined. WESTERN AUSTRALIA: Bandalup Hill, 30 km E of Ravensthorpe, Dec. 1997, G. Cockerton & S. Skull 3899 (PERTH); Bandalup Hill, c. 31 km ENE of Ravensthorpe, 33°39'53"S, 120°24'01"E, 18 Feb. 1998, G.F. Craig 3622 (PERTH); Bandalup Hill, E of Ravensthorpe, 33°39'56"S, 120°23'55"E, 22 Nov. 1999, M. French 1101 (PERTH); type locality, 5 Nov. 2000, D. Nicolle 3580 & M. French (AD, CANB, PERTH); E side of Bandalup Hill near Jerdacuttup, 1994, P. White s.n. (PERTH).

Distribution and habitat. Known from a single population south-east of Bandalup Hill, between Ravensthorpe and Jerdacuttup, in south-west Western Australia. It grows on the eastern and north-eastern slopes of a broad ridge of white, magnesite-influenced powdery loam. *E. purpurata* mainly occurs in a more or less pure stand with an understorey dominated by *Melaleuca haplantha* and *Leptomeria pachyclada*. Downslope, *E. indurata* Brooker & Hopper and *E. pleurocorys* L.A.S. Johnson & K.D. Hill are associated with the new species.

Flowering period. Recorded in flower in November 2000.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. The single known population covers approximately 18 hectares (45 acres). Aerial surveys have been carried out in the area specifically to survey for further populations (G. Craig pers. comm.), but no more populations have been found. The species should be considered for inclusion on Western Australia's schedule of Declared Rare Flora, having been subject to intensive surveys. Mining and poor fire management (high fire frequency) are considered to be the main threats. Locality data have not been masked in this publication as the plants are large and produce abundant viable seeds, thus collection of specimens or seed are not considered to be a threat to the species.

Etymology. From the Latin *purpuratus* (purple) referring to the distinctive and diagnostic red-purple new growth (leaves, branchlets and buds).

Affinities. Closest to *Eucalyptus argyphaea* L.A.S. Johnson & K.D. Hill, readily distinguished in the field by its intensely purple-red new foliage, branchlets and buds (yellow-green to pale red-green in *E. argyphaea*), giving the crown a dark purple-green aspect. Herbarium specimens of *E. purpurata* without any new growth can be distinguished from *E. argyphaea* by their smaller buds and fruits (buds 16–21 mm long and 5–7 mm wide, fruit 6–8 mm long and 5–7 mm wide in *E. argyphaea*).

Notes. *Eucalyptus purpurata* is highly distinctive in the field due to its crown of purplish new growth, and appears to have remained undiscovered until relatively recently due to its limited distribution. The population cannot be seen from any roads with the exception of Jerdacuttup West Rd, just west of Jerdacuttup, where part of the population is visible approximately six kilometres to the north-west. Initial cultivation trials at Currency Creek Arboretum (South Australia) indicate the purplish new growth is retained when the species is grown outside its natural habitat.

Molecular data support the description of *E. purpurata* as a distinct taxon. Using Amplified Fragment Length polymorphisms (AFLP), S. Krauss (unpub. data) assessed variation both within *E. purpurata* and between *E. purpurata* and the more widespread *E. argyphaea*. The study indicated high levels of genetic diversity within *E. purpurata* and found that *E. purpurata* is significantly genetically distinct from *E. argyphaea*.

Acknowledgements

I wish to thank Malcolm French for bringing both new species to my attention and for greatly appreciated hospitality and field assistance in Western Australia. Gillian Craig (who in turn brought *E. purpurata* to the attention of M. French) and Geoff Cockerton are thanked for sharing history and site data (with the permission of Ravensthorpe Nickel Operation) regarding *E. purpurata*. Siegy Krauss (Kings Park and Botanic Garden, Perth) was most helpful in sharing unpublished results of a genetic study involving *E. purpurata*, commissioned by Landcare Services Pty Ltd.

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One new *Banksia* and two new *Grevillea* species (Proteaceae: Grevilleoideae) from Western Australia

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Abstract

Olde, Peter M. and Marriott, Neil R. One new *Banksia* and two new *Grevillea* species (Proteaceae: Grevilleoideae) from Western Australia. *Nuytsia* 15(1): 85–99 (2002). *Banksia rosserae* P. Olde & N. Marriott, a new species of *Banksia* R. Br., *Grevillea kirkalocka* P. Olde & N. Marriott and *G. squiresae* P. Olde & N. Marriott, two new species of *Grevillea* R. Br. (Proteaceae: Grevilleoideae) are described. Their affinities are discussed and keys are provided. All of the new species have conservation priority.

Introduction

Three newly discovered species in the Western Australian Proteaceae are described here. The discovery of *Grevillea squiresae*, in the South West Botanical Province is not surprising, given the biodiversity of south-west Western Australia and the rising base of knowledge about its flora in particular. That two new members of the Proteaceae, *Banksia rosserae* and *Grevillea kirkalocka*, should be discovered in the same place in the Eremaean Province of the vast arid zone highlights our still restricted knowledge about the Australian flora, which has been largely built from collections on public roadsides. These two discoveries in the Mount Magnet area result from plant surveys on private and reserve land, an increasingly important resource in the emergence of new species. The existence of areas of deep yellow sand heath in this region is not widely known and these areas have only recently been sampled botanically. *Banksia rosserae* is geographically isolated from the remainder of its genus and is the only species that occurs exclusively in a desert region.

All of the new taxa and their closest relatives have been seen in the field. Conservation codes are those used by the Western Australian Department of Conservation and Land Management. In all descriptions we have preferred the term confluence to inflorescence, following Johnson & Briggs (1975) and Briggs & Johnson (1979).

Taxonomy

Placement of new species in *Banksia* R.Br.

Depending on which authority is followed, the number of accepted *Banksia* species prior to the circumscription of *Banksia rosserae* ranged between 76 (George 1999) and 80 (Thiele & Ladiges 1996). Recognition of *B. cunninghamii* Sieber ex Reichb. at specific rank is maintained at NSW though not by either George or Thiele & Ladiges (Harden 2002).

Banksia rosserae is here treated provisionally as a member of subgenus *Banksia*, section *Banksia*, series *Cyrtostylis* (Benth.) A.S. George. The inclusion of *B. rosserae* means that there are now 14 species in this series. Series *Cyrtostylis* was erected as a series and more closely defined by A.S. George in 1981. It differs from Bentham's concept of it as a section where, through a process of delimitation by elimination, it acts "as a repository for a disparate collection of otherwise unplaced species" (Thiele & Ladiges 1996: 662). Only three species placed in the section by Bentham were retained by George, the others being referred to three other series.

Important characters defining series *Cyrtostylis* given by George (George 1981 & 1999) are: *cotyledons* obovate to rounded-cuneate, often crenulate, sometimes emarginate; *shrub* or *tree* habit, lignotuberous or not; *leaves* alternate, serrate or triangular-lobed with flat or slightly recurved margins; *conflorescence* terminal or on short lateral branchlets, cylindrical, ovoid or spherical, erect or in one (now two) species pendulous, the buds typically losing regular pattern before anthesis; *perianth* glabrous to villous, quite straight or sometimes with the limb somewhat upturned before anthesis, relaxed after anthesis, yellow, ferruginous, orange or reddish; *tepals* not awned; *pistil* straight or gently curved; *pollen*-presenter usually less than 3 mm long, slightly thickened, finely costate or smooth; *pollen* crescent-shaped; *follicles* elliptic mostly less than 2 cm long, laterally beaked after opening, split from styler point; *seed wing* notched.

Many of these defining character states are also common to other series, especially series *Tetragonae* A.S. George, and *B. rosserae* also shares many diagnostic features including glabrous perianths and pendent confluences common to species in this series. It also keys out to this series in his key to infrageneric taxa (George 1999: 177).

George (1981: 345 & 1999: 214) has referred to his series *Cyrtostylis* as being 'rather heterogeneous'. After undertaking a phylogenetic analysis of *Banksia* based on 104 morphological and anatomical characters using cladistic parsimony methods, Thiele & Ladiges found no apparent synapomorphies for series *Cyrtostylis* and have referred to it as 'widely polyphyletic' (Thiele & Ladiges 1996: 715). They have proposed a classification in which not all taxa are placed in a higher-level taxon. The basis for this is that it more accurately reflects current knowledge and that taxa placed uncertainly now are most likely to be moved anyway within the cladogram after new data are analysed. These taxa are left *incertae sedis*.

The 'clearly non-monophyletic' series *Cyrtostylis sensu* A.S. George has been virtually dismantled by Thiele & Ladiges, splitting it into three narrowly defined series and leaving four species *incertae sedis*. *Banksia elegans*, a possible sister taxon to subgenus *Isostylis*, has been removed from subgenus *Banksia* altogether, thus rendering both taxa monophyletic. *Banksia elderiana* has also been removed from series *Cyrtostylis* and placed with other species that have pendent confluences and straight styles in a redefined series *Tetragonae*. The original concept of series *Cyrtostylis* has been redefined to a monophyletic grouping of only four species. Two additional series have been erected, a

monospecific series *Lindleyana* K. Thiele and series *Ochraceae* K. Thiele with three species, one of which is *B. laevigata*. *Banksia attenuata*, *B. ashbyi*, and *B. lullfitzii* remain *incertae sedis* within subgenus *Banksia*.

The analysis has “produced a generally poor match with existing taxonomy” (Thiele & Ladiges 1996: 661) and with so many unresolved taxa must be regarded as a first-step analysis only. George (1999: 176) has also disagreed with many of their placements, including the transfer of *B. elderiana* into series *Tetragonae*, preferring a broader grouping that has been provisionally followed here, “until further data tell us otherwise”.

Plant material from which the diagnosis of *B. rosserae* was made was collected at the post-anthesis stage and this has prevented us from making observations on some defining character states including floral development, flower colour, arrangement of perianth limbs at anthesis, orientation and flexing of the perianth limb before and during anthesis, exertion characteristics of the style before anthesis, pollen characters.. We have perceived a close relationship between *Banksia laevigata* and *B. rosserae* which a more informed study may find superficial. Until more data are collected on some of the character states employed by A.S. George and Thiele & Ladiges, *B. rosserae* cannot be placed with certainty in either scheme.

The *Banksia* description closely follows the format and terminology used by George (1981) except that Thiele & Ladiges (1996) have provided the model for description of the style end. An attempt has also been made to describe, where possible, other character states introduced in their study.

Amendments to *Banksia* keys

The key to infrageneric taxa of *Banksia* in “Flora of Australia” Volume 17B (George 1999: 177) breaks down at lead 9 and is here amended only in the most basic manner because important characters such as exertion of the style before anthesis, timing of tepal relaxation after anthesis, pollen shape and bud arrangement remain to be observed from fresher material.

- 9 Conflorescence pendulous; perianth limb glabrous, tetragonous, with tepal limbs prominently keeled; pistil not laterally exerted between tepals before anthesis; tepals separating around pollen-presenter but not immediately relaxing at anthesis; pollen-presenter 4–8 mm long, muricate ser. 7. **Tetragonae**
- 9: Conflorescence erect (pendulous in *B. elderiana* and *B. rosserae*); perianth limb either hairy or if glabrous then not tetragonous, the tepal limbs not prominently keeled; pistil usually laterally exerted between tepals before anthesis; tepals usually relaxed after anthesis; pollen-presenter commonly less than 3 mm long, rarely to 5 mm, smooth

The key to species of *Banksia* in “Flora of Australia” Volume 17B (George 1999: 178–184) is modified by insertion of the couplet at 41a on page 180.

- 40 Perianth glabrous
- 41 Conflorescences pendulous
- 41a Conflorescences spherical or narrow-ellipsoid with axis 3–3.5 cm long; perianth limb not tetragonous; style hairy in the basal 3–4 mm; follicle 10–22 mm long **B. rosserae**

41a: Conflorescences cylindrical, barrel-shaped, ovoid with axis 5–11 cm long;
perianth limb tetragonous; style glabrous; follicle 30–45 mm long

42 Leaf lobes \pm obtuse, 1–3 mm long **B. lemanniana**

Banksia rosserae P. Olde & N. Marriott, *sp. nov.*

A *Banksia laevigata* Meissner habitu lignotuberoso, cortice praecipue prope basem fruticis papyracea, conflorescentiis minoribus et nutantibus, perianthio glabro, bracteis non aristatis, stylo sparsim tomentoso basem versus, fructibus minoribus, folliculis maioribus et conspicuioribus differt.

Typus: near Mount Magnet [exact location withheld for conservation reasons], Western Australia, 4 September 2001, K. Alcock 902 (*holo*: PERTH; *iso*: MEL, NSW).

Differs from *Banksia laevigata* Meissner in its lignotuberos habit, in its papery bark (especially near the base of the shrub), in its smaller, nodding conflorescences, its bracts not awned, its perianth glabrous, the style sparsely tomentose near the base and in its smaller infructescences with larger and more conspicuous follicles.

Cotyledons spreading, obovate-cuneate, with upper margin oblique and crenulate, flat to concave, 9–14 mm long, 5–14 mm wide, medium green with a red margin, reticulate; upper surface flat to concave, prominently reticulate; margin oblique and the apex slightly crenulate: auricles horizontal to slightly descending, acute, 1.5–2 mm long. *Hypocotyl* 5–9 mm long, 2 mm thick, slightly pilose, reddish. *Seedling* leaves crowded, first 2–4 pairs opposite, obovate-cuneate; first pair 11–19 mm long, 5–8 mm wide, margins \pm flat, apically to sub-apically lobed with 4–6 acute lobes, subsequent pairs 1.5–4 cm long, 10–16 mm wide, margins slightly recurved, dentate with 4–7 acute-triangular lobes 2–4 mm long; upper surface reticulate, pilose; lower surface pilose on midrib, the lamina cobwebby. *Seedling stem* not observable. *Mature plant* a multi-stemmed, open-branched shrub 2.5–3 m high, 3–4 m wide, with lignotuber up to 1 m across. *Trunks* 10–15 cm wide, epicormic buds visible on some. *Bark* papery, flaky-rough, grey with reddish new bark beneath. *Branchlets* grey, terete, occasionally fissured, tomentose-hirsute, the indumentum sparse to dense, mostly consisting of short, tightly curled trichomes and occasional longer straight to wavy trichomes, the latter more numerous around leaf nodes; prophylls occasional, narrowly linear-subulate, 5–6 mm long, tomentose-hirsute; short side branches frequent; internodes irregular, sometimes very short, occasionally 5 or 6 leaves clustered in a whorl around a single, mostly slightly expanded node. *Leaves* alternate, narrowly linear to obovate or narrow-elliptical, 5–12 cm long, 5–12(14) mm wide, scarcely discolorous; base cuneate; apex mostly acute, sometimes obtuse, mucronate; mucro rigid, non-pungent, 0.4–0.8 mm long; margins flat, serrulate to denticulate, sometimes the teeth concentrated in the upper 2/3, the sinuses 9–12(30) mm long shallow, broadly u-shaped, mostly irregular in length on the same leaf, the teeth 1–1.2 mm long, triangular, mostly terminated by a rigid, slightly pungent, ascending mucro 0.2–0.8 mm long, sometimes the mucro obscure, blunt; upper surface tomentose when juvenile, soon glabrous, smooth to slightly punctate, somewhat shiny; lower surface glabrous except for numerous white-woolly stomatal pits in lateral to ascending rows; venation consisting of a yellowish and prominently raised midvein on both surfaces, lateral venation obscure above, evident to obscure below; petiole 3–5 mm long narrow but broadening at the point of attachment; texture coriaceous. *Conflorescence* terminal on short or extended, leafy side-branches, sessile to shortly pedunculate, simple, spherical to slightly ovoid or compressed-ellipsoid, 4–5.5 cm long, 4–4.5 cm wide, or if including styles at anthesis 6–7 cm wide, dense, pendent on decurved branchlets or peduncle; conflorescence development to be determined; peduncle 1.2–2 cm long, strongly decurved or deflexed at or near the conflorescence base; axis 3–3.5 cm long, 5 mm wide at

widest point, narrowly elliptic in longitudinal section. *Involucral bracts* 3–5 mm long 1.2–1.5 mm wide, grey-tomentose, the proximal bracts linear, persistent, the distal bracts ovate, caducous. *Common bracts* narrowly obovoid-cuneate, 5.5–7 mm long, 1.2–2 mm wide, appressed-ferrugineo-hirsute with long straight hairs, the apex convex, glabrous. *Floral bracts* similar, linear to narrowly obovate, 3.5–5 mm long. *Flowers* borne over the whole distal surface of the axis, colour not seen *in vivo*, possibly yellow (A. Pilkington pers. comm.), light brown *in sicco*. *Perianth* 30–32 mm long including limb 4–5 mm long, glabrous; claws filiform, not awned, 1.8 mm wide; tepals relaxed and twisting strongly in the upper half after anthesis, adherent 3–4 mm above the base, the margins noticeably darker than the creamy central rib; limb narrowly ellipsoid, the segments not keeled, orientation before anthesis to be determined. *Anthers* linear, 2–2.8 mm mm long, 0.3 mm wide, with acute apex, the filament 0.2 mm long. *Hypogynous scales* oblong to linear, 1.8 mm long, translucent. *Pistil* 30–33 mm long; ovary villous at the apex, the hairs c. 0.6 mm long; style slender, straight over most of its length, slightly curved and narrowed below the pollen-presenter, sparsely tomentose-pubescent in the basal 3–4 mm, otherwise glabrous, exertion or not before anthesis not observed; style-end 2 mm long, scarcely wider than the style; shoulder transverse, neck quadrangular, c. 1 mm long; collar dilated slightly; pollen-presenter 1.25 mm long, 0.25 mm wide, linear, slightly compressed, smooth, finely costate, the apex obtuse; stigmatic groove subterminal, very oblique to lateral; *pollen* not seen. *Infructescence* spherical, 4.5–5 cm diam., old perianths and styles persistent, the apex of the styles sometimes recurved. *Follicles* (9)12–20(25), 10–22 mm long, 7–10 mm high, 5–13 mm wide, in plan view broadly elliptic, a few open without fire, most apparently opening after fire to c. 15 mm across; valves in side-view obliquely semi-elliptic, slightly enlarged on the stylar side with a broad lateral peak, opening from the stylar point exposing a short \pm lateral beak, notched on the underside at the stylar insertion point; stylar peg absent; outer surface densely grey-tomentose, smooth, broadly convex with a slightly raised, narrow central ridge below the suture; ridge obtuse, partially glabrous; suture fine; lips 0.5 mm wide, even. *Seed* 18–21 mm long, obovate-triangular, discolourous; seed body 7–10 mm long, 7–9 mm wide, obovate-cuneate with the base acute, the upper margin straight to slightly oblique, thickened on the outer face, ridged on the inner face, lateral margins straight and faintly to obviously flanged; inner surface convex, glistening black, rugose and with faint to evident semi-concentric wrinkling; outer surface convex, smooth to rugose with faint longitudinal wrinkles, grey-black; seed wing 9–12 mm wide, uniformly grey-black, darkly translucent, rugose, elliptic with an excurrent curve to the stylar side and drawn to a lateral point, notched below the apex on the underside forming a secondary obtuse lobe \pm erect from the upper margin of the seed body. *Separator* 18 mm long, 12 mm wide, \pm obovate-cuneate; apex slightly oblique and drawn to a lateral point, subreniform; valves thin, impressed by the seed body and wing, thicker near the apex, recurved in the apical quarter, ridged along the ventral axis, the base apiculate. (Figure 1)

Other specimen examined. WESTERN AUSTRALIA: near Mount Magnet [exact location withheld], 4 Sep. 2001, P. Olde & N. Marriott 01/114 (NSW, PERTH).

Distribution. Western Australia; known only from an area south-south-east of Mount Magnet in the Murchison Region of the Austin District in the Ereman Province. There are apparently several populations in the district (A. Pilkington pers. comm.). Specimens of *Banksia* have not previously been collected in the Murchison Region although the distribution of *B. elderiana* extends to Victoria Spring in the adjacent Great Victoria Desert Region. The distribution of *Banksia rosserae* represents both a significant extension of range into the arid zone and a significant geographic disjunction for the genus.

Habitat and ecology. Dominant with mallee eucalypts in deep yellow sand and laterite with open heath flora including *Grevillea kirkalocka*, *G. acacioides*, *G. juncifolia* subsp. *juncifolia*, *G. biformis* subsp. *biformis*, *G. apiculoba* subsp. *apiculoba*, *Hakea invaginata*, *Leptospermum* sp., *Melaleuca* sp.,

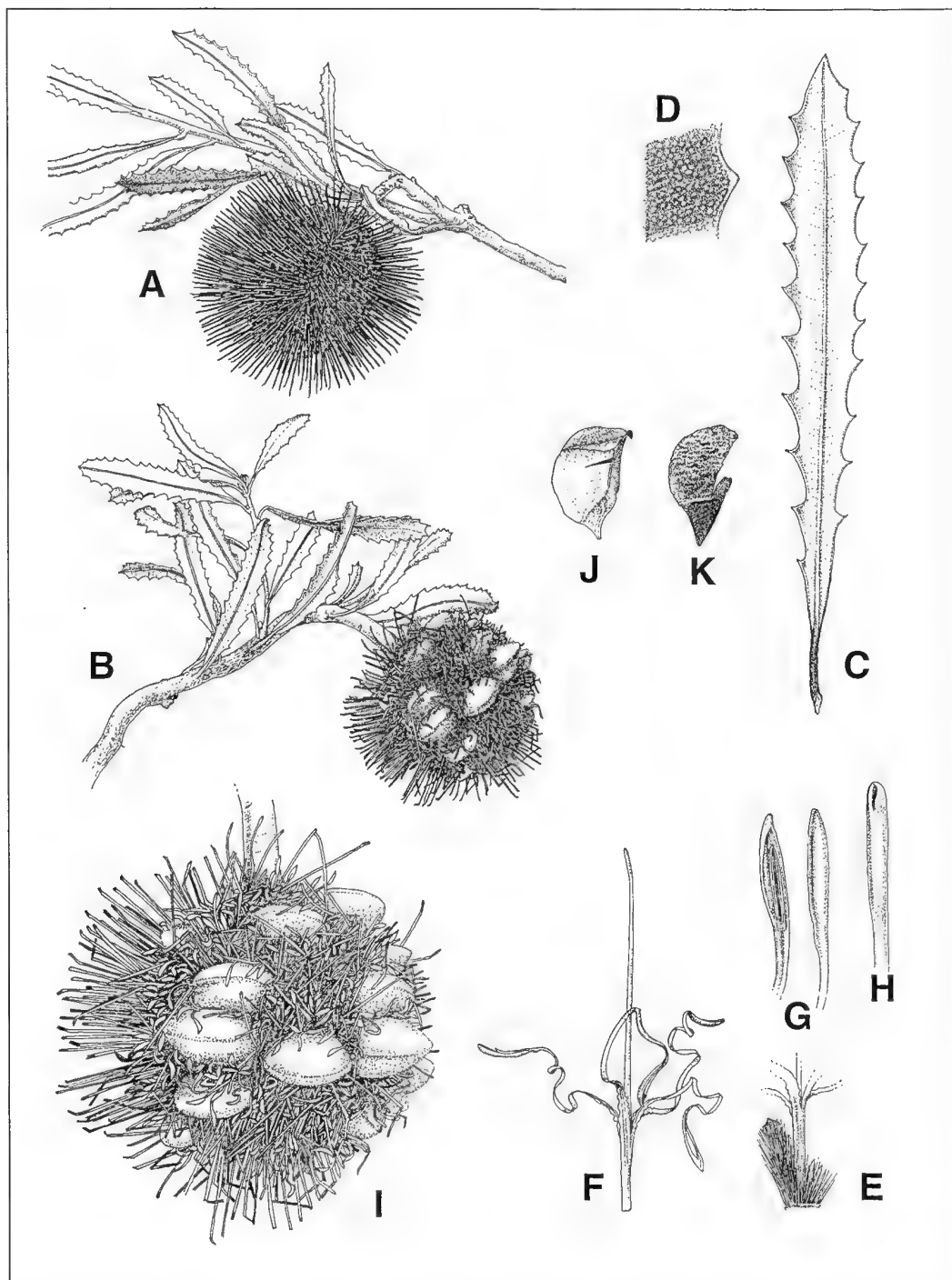


Figure 1. *Banksia rosserae*. A – flowering branch (x0.5), B – fruiting branch (x0.5), C – leaf (x1), D – portion of undersurface of leaf (x5), E – floral bract and base of perianth (x2), F – perianth (x2), G – inner and outer views of perianth limb (x5), H – style end (x10), I – infructescence (x1), J – separator (x1), K – seed (x1).

Cryptandra sp., *Triodia basedowii*. Although the distribution is in the arid zone, the flora associated with the new *Banksia* has more in common with sandplain flora of the South West Botanical Province.

Flowering period. Uncertain; probably late winter to early spring.

Fruiting period. Late spring onwards.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. The species is known from a single small population of 20 individuals on private land. The precise location is withheld for conservation purposes. Although systematic surveys of the adjoining reserve may well reveal further populations, the species appears to be of high priority for conservation.

Etymology. Named in honour of Celia Elizabeth Rosser (nee Prince) M Sc., OAM (1930–) of Box Hill Victoria, acclaimed botanical artist who, while employed as Science Faculty Artist at Monash University, Melbourne painted every species of *Banksia* for “The Banksias” a three-part monograph which confirmed her standing as one of the world’s greatest botanical illustrators.

Affinities. The diagnostic features distinguishing *B. rosserae* are lignotuberous (and epicormic) habit, papery bark around the base of stems, shortly dentate, relatively small obovate- to linear-cuneate leaves, nodding, round to slightly ovoid, dense and relatively small conflorescences and infructescences, glabrous perianth, slender style sparsely hairy in the basal quarter and apparently (from dried specimens) slightly curved near the apex, follicles with a small lateral beak visible after opening.

Through a combination of leaves that are almost indistinguishable from narrow-leaved forms of *Banksia laevigata* in their shape, size and dentition, \pm round, condensed conflorescences, and slender-styled flowers, *B. rosserae* seems most closely related to *B. laevigata*. However, *B. laevigata* has a non-lignotuberous habit, a hairy perianth and awned common bracts. *B. rosserae* shares with *B. lullfitzii* a lignotuberous habit, similar bracts and styler indumentum. It is one of only two species in the series (*sensu* George) with pendent conflorescences and one of three with spherical conflorescences.

Banksia rosserae keys out with and also has affinities with species in series *Tetragonae* *sensu* George (1981), notably through its glabrous perianth and pendent conflorescences. However it lacks the diagnostic tetragonous perianth limb (the tepal limbs are not keeled) and the plants are lignotuberous. It further lacks the muricate pollen-presenter, regarded by Thiele & Ladiges as a synapomorphy of the series, and the perianth is both shorter than the pistil and relaxed after anthesis. A more detailed analysis beyond the scope of this paper is required to clarify the relationship between species within series *Tetragonae* and series *Cyrtostylis*.

Placement of new species in *Grevillea* R.Br.

Both *Grevillea kirkalocka*, which appears to be most closely related to *Grevillea nana* C.A. Gardner, and *G. squiresae*, which appears to be most closely related to *G. aneura* McGill., are members of Group 35 *sensu* Olde & Marriott (1994b), a large group of mainly toothbrush grevilleas that occurs over most botanical districts of Australia. Coincidentally, both new species are also closely related to each other. The two new species belong in Subgroup *Asplenifolia/Hookeriana* of the *Pteridifolia* Group *sensu* Makinson (2000). The *Pteridifolia* Group corresponds to our Groups 32, 34 and 35 where they are treated as subgroups. It is likely that the groupings in both schemes are polyphyletic and will need to be separated. A phylogenetic study of *Grevillea* remains an urgent priority.

The principal character states that define Group 35 are leaves dorsiventral, discolorous; torus straight or oblique; perianth zygomorphic, glabrous on the inner surface (ignoring hairs about the anthers in a few species); ovary densely hairy; style longer than the perianth and looped out before anthesis; fruits bearing hairs with reddish or brown contents in stripes or blotches.

The *Grevillea* species descriptions closely follow the format and terminology used by D.J. McGillivray (1993) though some modifications and changes have been incorporated. Methods of working, additional characters and clarifications of morphological terminology have been outlined in Olde & Marriott (1993a, 1993b, 1994a, 1994b, 1995).

Short key to the new species of *Grevillea*

- 1 Leaves dorsiventral with lower surface 1- or 2-grooved
- 2 Some or all leaves with secondary division **G. kirkalocka**
- 2* All leaves with primary division
- 3 Perianth limb glabrous or almost so; fruits 11–12 mm long; nectary obscure.. **G. kirkalocka**
- 3* Perianth limb densely hairy; fruits 15–19 mm long; nectary prominent **G. nana**
- 4 Perianth limb densely hairy; basal leaf lobes patent to spreading, widely divaricate and divergent from the rachis; leaves and leafy branches often entangled **G. nana**
- 4* Perianth limb either glabrous or almost so; basal leaf lobes ascending, not widely divergent laterally from the rachis; leaves and leafy branches not usually entangled **G. tenuiloba**
- 1* Leaves subterete-dipleural (i.e. with a longitudinal groove along each side)
5. Ovarian stipe 3.3–5 mm long; primary leaf lobes usually 3; fruits lacking glandular hairs **G. aneura**
- 5* Ovarian stipe < 1 mm long; primary leaf lobes usually 5; fruits with glandular hairs **G. squiresae**

Amendments to *Grevillea* key

The following is an amendment to the key to species of group 35, in "The *Grevillea* Book" Volume 1 (Olde & Marriott 1994b: 218–219). It is amended by substituting all leads between lead 35 and lead 35*.

- 35 Leaves subpinnatisect; leaf undersurface either not visible or enclosed by revolute margins
- 36 Leaf lobes subterete-dipleural (i.e with a [hair-filled] groove along each side)
- 37 Ovarian stipe 3.3–5 mm long; primary leaf lobes usually 3; fruits lacking glandular hairs **G. aneura**
- 37* Ovarian stipe < 1 mm long; primary leaf lobes usually 5; fruits with glandular hairs **G. squire**
- 36* Leaf lobes dorsiventral with one or two grooves clearly confined to the lower surface
- 38 All leaves with primary division only
- 39 Leaf lobes rigid, pungent; style gradually thickened over the apical few mm into the style end
- 40 Perianth limb glabrous (rarely with occasional scattered hairs); leaf lobes closely aligned and straight, often with a raised midvein on upper surface; leaves and leafy branches not usually entangled **G. tenuiloba**
- 40* Perianth limb densely hairy; leaf lobes patent to spreading, widely divaricate and divergent from the rachis; leaves and leafy branches often entangled **G. nana**

- 39* Leaf lobes non-rigid, non-pungent to scarcely pungent; style-end abruptly divergent from line of style
- 41 Pistil > 22 mm long; pollen-presenter usually > 1 mm wide; stylar indumentum extending > 2 mm beyond ovary **G. baxteri**
- 41* Pistil < 22 mm long; pollen-presenter < 1 mm wide; stylar indumentum extending < 2 mm beyond ovary **G. cagiana**
- 38* Some or all leaves with secondary division
- 42 Ovary villous with many ascending to spreading hairs, sometimes evident at the apex only; ultimate leaf lobes straight; floral bracts 0.8–5 mm long
- 42a Longest leaves > 10 cm long **G. nana**
- 42a* Longest leaves < 6.5 cm long
- 42b Pedicels 4–4.5 mm long; torus 2 mm wide, oblique at 40–60 degrees; pollen-presenter very oblique to lateral; some of all conflorescence repent **G. kirkalocka**
- 42b* Pedicels 2.5–3 mm long; torus < 2 mm wide, \pm straight; pollen-presenter oblique at c. 40 degrees; conflorescences not repent **G. treueriana**
- 42* Ovary silky with all hairs closely appressed; ultimate leaf lobes wavy; floral bracts 0.3–0.7 mm long **G. ilicifolia**
- 35* Leaves either simple and entire or toothed, or if deeply divided then the undersurface exposed

Grevillea kirkalocka* P. Olde & N. Marriott, *sp. nov.

Affinis *Grevilleae nanae* C.A. Gardner sed foliis bipartitis, perianthii limbo fere glabro, ovario adpresso-villoso, nectario obscuro, folliculis minoribus differt.

Typus: Kirkalocka Station, [exact location withheld for conservation reasons], Western Australia, 30 August 1995, S. Toole SLT 52 (*holo:* PERTH 04621883).

Related to *Grevillea nana* C.A. Gardner but differing in its twice-divided leaves, its almost glabrous perianth limb, appressed-villous ovary, obscure nectary, and smaller fruits.

A low spreading to decumbent *shrub* 0.4–0.6(1) m high, 1–1.5 m wide, with down-arching branches, with at least some floral branches on the ground; juvenile growth loosely villous with hairs both red and white; branchlets rounded, stout, openly tomentose with prominent, glabrous ribs decurrent from mid- and edge-vein leaf traces, the ribs extending down and terminating below adjacent leaf nodes. *Leaves* spreading to patent, crowded and somewhat entangled, subsessile, 4–6 cm long c. 6 cm wide, widely and divaricately 3–5 partite; primary lobes occasionally simple, mostly tripartite; basal lobes c. 1 cm from point of attachment; ultimate lobes narrow-linear, 1.2–2.2 cm long, 1.2 mm wide; apices pungent; leaf base linear; margins smoothly revolute; upper surface glabrous, smooth; lower surface bisulcate, curly hairs occasionally visible at the leaf sinuses and beside the midvein; venation obscure on the upper surface or the midvein faintly evident in the lamina, the midvein below prominent, rounded; texture rigidly coriaceous. *Conflorescence* erect, pedunculate, 3–5-branched, terminal or subterminal in the upper axils; unit conflorescences 6–8 cm long, conico-secund, dense but sometimes with scattered, widely spaced, uniflorescences at the proximal end; floral development acropetal; primary peduncles 8 mm long, tomentose, angularly ribbed; floral rachises slightly incurved, villous before anthesis, becoming sericeo-tomentose at and just after anthesis; conflorescence bracts 4–5.5 mm long, triangular with attenuate apex; floral bracts linear-subulate to ovate-acuminate, 1.8–5 mm long 0.2–2 mm wide, glabrous with ciliate margins, sometimes a few evanescent hairs outside, strongly concavitous at the

base, caducous. *Flowers* acroscopic, perianth and styles red; pedicels 4–4.2 mm long, sericeo-tomentose; torus 2 mm across, oblique at c. 45 degrees, cupuliform; nectary patelliform, lining the inner surface of the torus and extending 0.1 mm above the toral rim. *Perianth* zygomorphic, narrowly ovoid with slight basal dilation, gently recurved below the limb, 8–9 mm long, 2–2.2 mm wide, openly sericeous outside, glabrous inside, separating along the dorsal suture at the curve before anthesis and the style exerting and looping strongly first upwards and ultimately out to the ventral side; limb spheroidal, revolute, sericeous in bud, the hairs falling variably through development, ultimately glabrous at the apex and less dense overall on the limb than the perianth just before anthesis. *Pistil* c. 25 mm long; stipe c. 0.8 mm long, partly enclosed in the torus and adnate dorsally, rising c. 0.4 mm above the toral rim, sericeous; ovary 1.2 mm long, subtriangular, appressed white-villous; style glabrous from just above the ovary, dilating slightly from just below the style-end; style-end partially exposed dorsally before anthesis through partial separation of the suture; pollen-presenter 2 mm long, 1.25 mm wide, lateral to very oblique, round with cushion-like central boss and minute encircling flange; stigma central. *Fruits* 11–12 mm long, 9–10 mm wide, ovate to subhemispherical in side-view with apiculum 2.5–3 mm long, retrorse on the pedicels, the outside tomentose with glandular hairs interspersed, reddish stripes and blotches forming on young fruits, most hairs except a few glandular ones falling with age, the surface ultimately cracking and excoriating; inner surface slightly rugose; pericarp 0.6 mm thick throughout; texture crustaceous. *Seeds* not seen. (Figure 2)

Other specimens examined. WESTERN AUSTRALIA: Kirkalocka Station [exact locations withheld for conservation reasons], 3 Sep. 2001, P. Olde, N. Marriott & K. Alcock 01/76, 01/83, 01/84 (NSW, PERTH).

Distribution. Western Australia; known only from a few sites at or within 20 km of the type locality.

Habitat and ecology. Grows in yellow sand with some ironstone gravel in open, mixed sandheath dominated by mallee eucalypt, several *Acacia* spp., *Banksia rosserae* (at one site only), and *Triodia basedowii*. with *Grevillea acacioides*, *G. pterosperma* (at one site), *G. apiculoba* subsp. *apiculoba*, *G. biformis* subsp. *biformis*, *Calothamnus* sp., *Melaleuca* sp. aff. *filifolia*, *Stylidium repens*, *Baeckea* sp., *Hakea invaginata*.

Flowering period. Late winter to early spring.

Fruiting period. Probably late spring

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Only known from a few sites on private land.

Etymology. Named *kirkalocka* after the station on which this species was found and as a mark of respect for the proprietors who have a progressive conservation ethic. The epithet is used as a noun in apposition and is indeclinable.

Typification. Although *G. kirkalocka* has been seen in the field, none of the plants were flowering and all fruits were without seed. Regrettably, there are no isotypes for distribution.

Affinities. Closely related species have a similar style-end which does not abruptly diverge from the style and expand as it does in most species but rather the style gradually and evenly dilates in the apical few millimetres into the style-end. *Grevillea kirkalocka* appears most closely related to *G. nana*

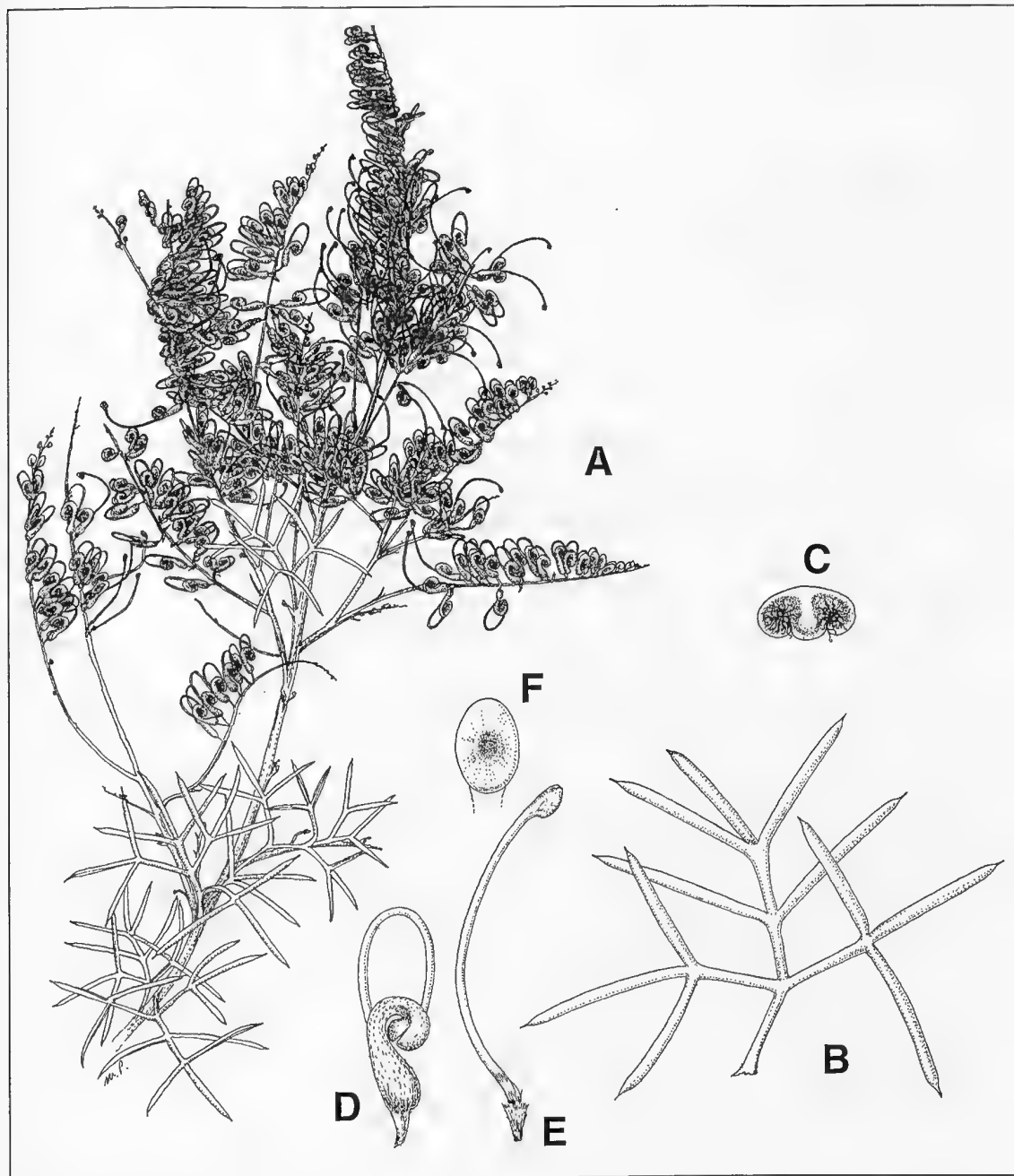


Figure 2. *Grevillea kirkalocka*. A – habit (x0.5), B – leaf (x1), C – cross-section of leaf (x6), D – perianth (x2), E – pistil (x2), F – style end (x6).

C.A. Gardner and *G. tenuiloba* C.A. Gardner and is perhaps more distantly related to *G. aneura* McGill. and *G. squiresae*. *G. nana* differs in having leaves usually with primary division only, in its subsericeous-subvillous ovary, in its densely subsericeous to lanate outer perianth surface with the limb densely hairy and in its larger fruits (15–19 mm long). A recent collection of *G. nana* has some twice-divided leaves suggesting that this character may be less important than previously thought. Most collections of *G. nana* also have a prominent linguiform nectary, although some specimens with a less oblique torus tend also to have the nectary more obscure (McGillivray 1993: 368). Further collections

in late fruit are needed to determine whether *G. kirkalocka* has similar corky seeds to *G. nana*. Seed morphology of *G. nana* appears to be unique in Group 35, although not all species in the group have been examined (e.g. *G. squiresae*).

Grevillea tenuiloba differs from *G. kirkalocka* in also having only primary leaf division but also has ascending, closely aligned basal leaf lobes that diverge only a short distance laterally from the rachis and which often have a prominent midvein on the upper surface. It further differs in its smaller, less oblique pollen-presenter (at 15–25 degrees), its subsericeous-tomentose ovary with duller, shorter hairs, its glabrescent outer perianth surface, and in its glabrous perianth limb. *G. aneura* and *G. squiresae* have dipleurale leaves, and a sericeous perianth limb. It should be remembered that character states described are based on very limited material and may require modification.

Grevillea squiresae* P. Olde & N. Marriott, *sp. nov.

Affinis *Grevilleae aneurae* McGill. sed foliis longioribus, pinnatipartitis plerum quinque primis lobis insertis, toro aut recto aut vix obliquo, nectario linguiformi, bracteis florum persistentibus, stipite ovarii brevissimo, fructibus glanduliferibus differt.

Typus: east of Mukinbudin [exact location withheld for conservation reasons], Western Australia, 28 September 1999, P. Olde & N. Marriott 99/28 (*holo*: NSW; *iso*: PERTH).

Related to *Grevillea aneura* McGill. but differing in its longer, pinnatipartite leaves with usually five primary lobes, its torus straight or slightly oblique, its linguiform nectary, persistent floral bracts, its ovary very shortly stipitate and in its glandular-haired fruits.

Single-stemmed *shrub* to c. 1 m high and 1 m wide; juvenile growth not seen; branchlets rounded, slender, silky becoming sparsely so with age, with glabrous ribs decurrent from leaf bases. *Leaves* ascending, not crowded, tangled when dry, sessile, 4.5–10.5 cm long, usually divaricately pinnatipartite, sometimes irregularly partite; primary lobes 3–5(7), occasionally simple, sometimes biternate, mostly some lobes secondarily tri- or occasionally bipartite, rarely with tertiary bi- or tri-sect division; basal lobes inserted 1–3 cm from point of attachment; ultimate lobes 1.4–4 cm long, 0.5–1.3 mm wide, subterete-dipleurale, on broader lobes the lateral grooves visibly packed with appressed hairs, otherwise the grooves scarcely visible and tightly abutting; apices pungent; leaf base linear; margins smoothly revolute; upper and lower surfaces similar, glabrous or sometimes scattered appressed biramous hairs intermixed with minute, erect trichomes visible on the upper surface; venation not visible except the lower surface consisting of the midvein only; texture coriaceous. *Conflorescence* erect to decurved, sometimes on pendulous branches, shortly pedunculate, simple or 2-branched, terminal; unit conflorescences (3)4–8 cm long, conico-secund, somewhat lax; floral development acropetal; primary peduncles 2–5 mm long, sericeous, round; floral rachises straight to slightly sigmoid, sometimes ventrally concave, slender, sericeous to tomentose; conflorescence bracts ovate-apiculate, 1.8 mm long, 1.6 mm wide at base; floral bracts broadly ovate, 0.8 mm long, 1 mm wide, sericeous outside, glabrous inside, usually persistent to fruiting. *Flowers* acroscopic, perianth and styles red; pedicels 2–3.5 mm long, sericeous; torus 1.3–1.5 mm across, straight to slightly oblique, sometimes slightly concave in side-view; nectary broadly linguiform to patelliform usually with recurved margin, partially cupuliform and enclosed in the torus, extending 0.2 mm above the toral rim and extending 0.5 mm laterally beyond the torus. *Perianth* zygomorphic, ovoid-sigmoid, 8–10 mm long, 2–3 mm wide, sericeous outside, the hairs white or with reddish contents, glabrous inside, separating along the dorsal suture in the upper half before anthesis and the style looped strongly upwards; limb spheroidal, revolute, sericeous. *Pistil*

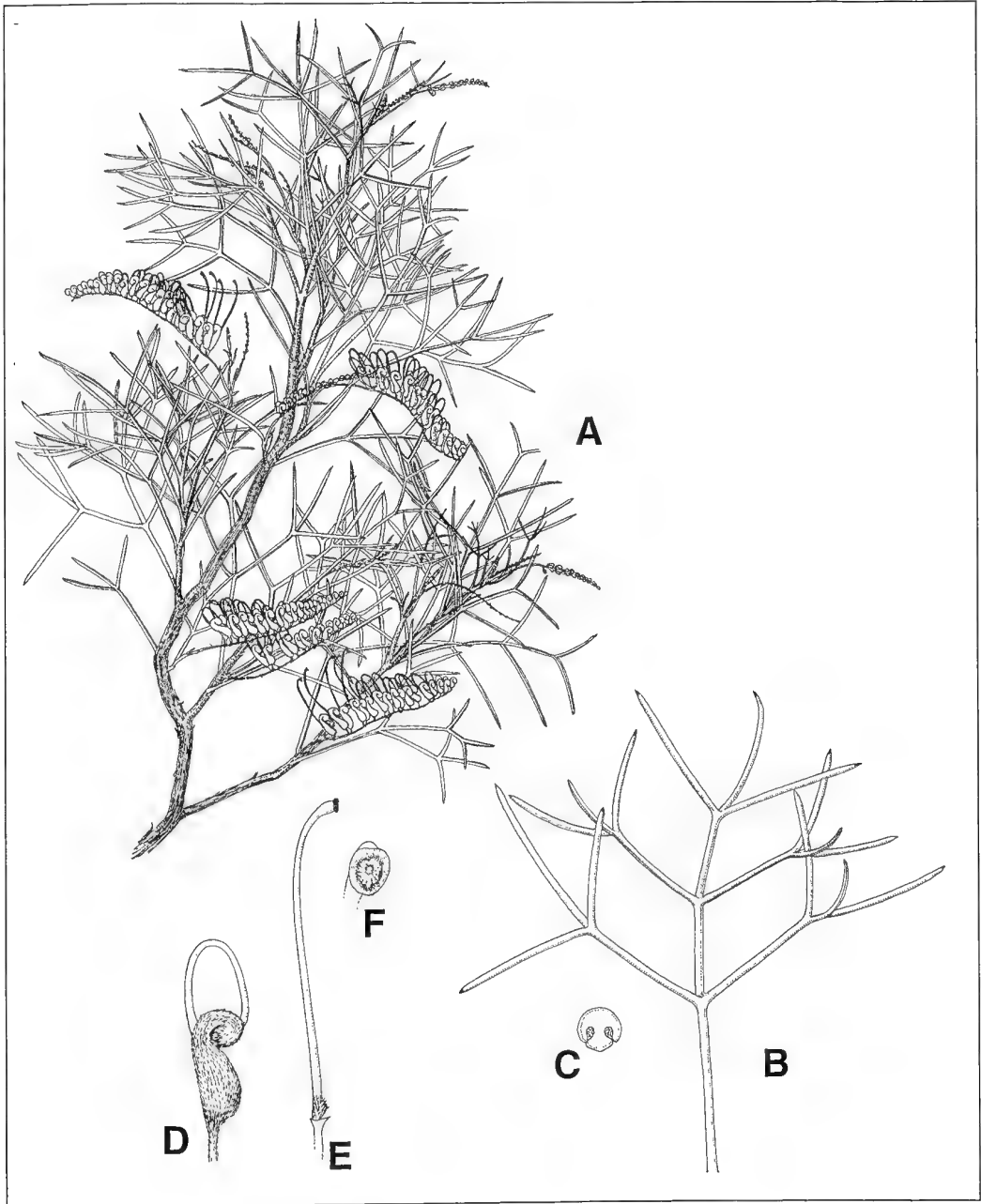


Figure 3. *Grevillea squiresae*. A – habit (x0.5), B – leaf (x1), C – cross-section of leaf (x6), D – perianth (x2), E – pistil (x2), F – style end (x6).

28–29 mm long; stipe 0.5–0.8 mm long, sericeous, about one third its length obscured within the torus; ovary 1 mm wide, 1 mm long, round, white-sericeous; style glabrous, except at base where usually hairs extend for c. 1 mm from top of ovary, apically recurved and gradually dilating c. 2 mm from the style-end; style-end partially exposed dorsally before anthesis through partial separation of the suture; pollen-presenter 1.8 mm long, 1 mm wide, oblique at c. 10–20 degrees, broadly elliptic, convex; stigma prominent, central. *Fruits* 15 mm long, 7–7.5 mm wide, ovoid, erect, white-sericeous with reddish stripes and patches extending over large areas of the surface and with numerous, late-developing glandular hairs intermixed; pericarp 0.2 mm thick; texture crustaceous. *Seeds* not seen. (Figure 3)

Distribution. Western Australia, near Mukinbudin.

Habitat and ecology. Grows in yellow sand in low heath with *Melaleuca*, *Dampiera* and *Baeckea* spp.

Flowering period. Spring.

Fruiting period. Probably late spring to early summer.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. *G. squiresae* is known from two populations, both near Mukinbudin. The type of population grows along a single roadside in a narrow but still undisturbed verge. Adjoining natural vegetation needs urgently to be surveyed as it may contain further remnant populations.

Etymology. Named in honour of Mary Alice Squires (nee McInnes) (1940–) of Mukinbudin, Western Australia who first discovered this species and drew attention to it.

Affinities. *Grevillea squiresae* is closely related to *G. aneura* and was initially mistaken for that species. *G. aneura* is distinguished by its tripartite leaves, usually with some secondary division of the primary lobes, its caducous floral bracts, its long-stipitate ovary (the stipe 3.3–5 mm long), its sub-annular to funnel-shaped nectary, its torus oblique at 20–30 degrees, its very oblique to almost lateral pollen-presenter, and in its sericeous fruits that have no glandular hairs. *G. aneura* generally has more spreading flowers on the confluences than *G. squiresae* which has strongly secund confluences. *G. aneura* is distributed from east of Lake King to Red Lake, well to the south-east of the known distribution of *G. squiresae*.

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We wish to thank Ann Pilkington who discovered *Banksia rosserae* and who drew it to our attention through various third parties. Ann and her husband Geoff Pilkington kindly gave permission to collect on their property. Special acknowledgement is given to Keith Alcock who located the *Banksia rosserae* population on our recent expedition after a long, difficult search. The Squires and Garlick families were particularly hospitable and generous in sharing knowledge and time. Our deepest appreciation is given also to Margaret Pieroni for the magnificent illustrations. The anonymous referee, through constructive suggestion and comment, has markedly improved the presentation and content of this paper. The authors also acknowledge with appreciation financial support provided towards their expeditionary expenses by the Grevillea Study Group of the Association of Societies for Growing Australian Plants. We appreciate greatly access to collections provided by the directors of herbaria at NSW and PERTH.

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A revision of south-western Australian species of *Micromyrtus* (Myrtaceae) with five antisepalous ribs on the hypanthium

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Abstract

Rye, B.L. A revision of south-western Australian species of *Micromyrtus* (Myrtaceae) with five antisepalous ribs on the hypanthium. *Nuytsia* 15(1): 101–122 (2002). Among the species currently included in *Micromyrtus* Benth., two main categories are distinguished here on the basis of hypanthium ribbing, one characterised by having antipetalous ribs and usually also antisepalous ones, the other by having antisepalous ribs but no antipetalous ones. Most species belong to the latter category, including the lectotype selected here for the genus, *Micromyrtus drummondii* Benth. *nom. superfl.* [= *M. obovata* (Turcz.) J.W. Green]. A key is given to the 14 Western Australian members of this group, and the eight south-western species, including five new species, are revised. *Micromyrtus erichsenii* Hemsl. is reinstated and the new species *M. monotaxis* Rye, *M. ninghanensis* Rye, *M. papillosa* J.W. Green ex Rye, *M. rogeri* J.W. Green ex Rye and *M. uniovula* Rye are illustrated. Three of these new species have an ovule number of one, lower than any previously recorded for the genus, and four of them have conservation priority.

Introduction

Micromyrtus is an endemic Australian genus belonging to the *Chamelaucium* alliance (cf. Briggs & Johnson 1979) of the Myrtaceae. No formal sections or other infrageneric groups have been named in *Micromyrtus*, although the genus was reduced to a section of *Thryptomene* Endl. by Mueller (1873), who then and subsequently described new taxa under *Thryptomene*. However, this was not followed in later taxonomic publications such as Bailey (1900) and Gardner (1931). The boundary between *Micromyrtus* and *Thryptomene* was confused when four atypical species were placed in one or both genera by Fitzgerald (1905), Pritzel (in Diels & Pritzel 1904) and Moore (1920). In the absence of a ready means to separate them, the two genera were keyed jointly in Blackall & Grieve (1980). This problem was remedied when Green (1983a) transferred the four atypical species into his new genus *Malleostemon* J.W. Green.

Since 1980, all of the 25 species of *Micromyrtus* known from central and eastern Australia have been treated in revisions or other taxonomic works (Bean 1996; Green 1980, 1983b; Hunter *et al.* 1996; Wilson 1991). Green's studies of the genus in south-western Australia were never completed, but he did erect a monotypic genus, *Corynanthera* J.W. Green (Green 1979), for one new south-western species that shares many diagnostic characters with *Micromyrtus*.

Green (1979: 373) stated "The ovary of *Corynanthera* closely resembles that of a group of species of *Micromyrtus* having 10 stamens and two ovules, suggesting a very close relationship." Strong evidence favouring this opinion is provided by unpublished molecular data, in which the 10-staminate and 2-ovulate *Micromyrtus elobata* (F. Muell.) Benth. formed a sister group with *Corynanthera* rather than associating with the five other *Micromyrtus* species that were sampled (Peter G. Wilson pers. comm.). The latter five species, *M. ciliata* (Sm.) Druce, *M. delicata* A.R. Bean, *M. gracilis* A.R. Bean, *M. hexamera* (Maid. & Betch) Maid. & Betch. and *M. erichsenii*, formed a clade.

Two main categories based on hypanthium ribbing can be distinguished among the *Micromyrtus* species, and these coincide with the two groups delimited by the molecular data. Most *Micromyrtus* species, including the five species forming a clade, have less than ten ribs, usually with one rib opposite each sepal, on the hypanthium. This large species group extends across the Australian mainland and has variable numbers of stamens (5–12) and ovules (1–10) per flower. In the other category, the one with closer affinities to *Corynanthera*, the hypanthium is usually 10-ribbed with one rib opposite each sepal and petal. This group, comprised of *M. elobata* and its relatives, is restricted to the south-west of Western Australia and consistently has ten stamens and two ovules.

Most of the species included in the genus *Micromyrtus* when it was originally described by Bentham (1865, 1867) belong to the more widespread and more speciose category lacking antipetalous ribs on the hypanthium. The purpose of the current paper is to nominate one of the members of this plant group as the lectotype of *Micromyrtus* and to complete the Australia-wide coverage of the group by revising the south-western species, all of which have a 5-ribbed hypanthium. A description applicable to this group throughout its range, and a key to the Western Australian species, are also given.

Methods

All measurements were from dry herbarium collections, with leaf and bracteole measurements taken from the largest of these structures on each specimen. Petal length and most other floral measurements were taken from well pressed mature flowers. Peduncle and style measurements were taken from mature flowers and from fruits. Fruit measurements include the adnate portions of the hypanthium and disc but do not include the length of the free portion of the hypanthium and the persistent sepals.

Distributions were plotted on maps showing the interim biogeographic regions of Thackway & Cresswell (1995) and the following abbreviations are used here for these regions. Botanical provinces are as defined by Beard (1980).

AW – Avon Wheatbelt
ESP – Esperance Plains
JF – Jarrah Forest
MUR – Murchison

COO – Coolgardie
GS – Geraldton Sandplain
MAL – Mallee
YAL – Yalgoo

Formal taxonomy

Micromyrtus Benth. in G. Bentham & J.D. Hooker, Gen. Pl. 1, 700 (1865). – *Thryptomene* sect. *Micromyrtus* (Benth.) F. Muell., Fragm. Phyt. Austral. 8, 13 (1873). Type: *Micromyrtus drummondii* Benth. nom. superfl. [= *Micromyrtus obovata* (Turcz.) J.W. Green], lectotype here nominated.

Description of the few-ribbed category. *Shrubs* almost prostrate to tall, glabrous. *Leaves* small, with a short or very short petiole, concolorous, gland-dotted, entire or with denticulate to lacinate margins. *Inflorescence* of a subterminal cluster-like or spike-like raceme on each branchlet, sometimes with additional racemes lower down on the same branchlet, with solitary axillary peduncles resembling pedicels, each flower sessile within 2 subtending bracteoles or rarely with an anthopodium; peduncles 1-flowered, ranging from very reduced to greatly exceeding the subtending leaf, terminated by very short hair-like processes. *Bracteoles* imbricate and partially to fully enclosing flower in bud, usually caducous or deciduous, smaller and more scarious than the leaves, the thickened midvein usually prominent on abaxial surface, with a subterminal abaxial protrusion or a terminal point. *Buds* with apex hemispheric. *Flowers* pentamerous in Western Australian species and most eastern Australian ones. *Hypanthium* either turbinate to narrowly obconic and terete to 5-angled, or slightly to very dorsiventrally compressed, adnate to ovary for more than half or almost all its length but with a slightly to widely flared free portion above, with prominent longitudinal ribs or with 5 angles opposite the sepals, sometimes also papillose to prominently rugose or bearded; ribs few at base but sometimes branching towards base or closer to the summit, 5–8(9), in most species one opposite each sepal, in two species the ribs up to 9 and irregularly positioned. *Sepals* 5 or 6, varying from extremely reduced to large and petal-like but distinctly smaller than the petals in most species, somewhat scarious and coloured to almost hyaline, entire or with denticulate to fimbriate margins. *Petals* the same number as the sepals, white in most taxa, pink or yellow in others. *Stamens* 5–10 or 12, with antipetalous ones inserted at summit of hypanthium and antisepalous ones (when present) inserted either at about the same level as antipetalous ones or inserted distinctly lower in the free part of the hypanthium; filament terete to lorate, narrowed at the top. *Anthers* dorsifixed, versatile, 2-celled, more or less oblong or oblong-elliptic, the cells dehiscent by a long slit with both ends reaching the edge of the cell, the slit longitudinal or oblique in relation to the connective; gland much smaller than each cell to almost as large, terminal, united to connective at basal end, which often has 2 lateral lobes, the apex free and directed towards inside of flower and sometimes protruding inwards distinctly beyond the anther cells, releasing contents via an apical pore as pollen is released from anther cells. *Ovary* 1-celled, with a small ovule-bearing cavity above the middle and often more or less terminal, the remainder of the cell filled with spongy tissue; placenta generally subterminal and lateral within the cavity, small; ovules 1–10, collateral, when 4 or more then radially arranged, attached above the middle and tending to be pendulous. *Style* central, terminal (not in a depression), with a simple capitate stigma. *Disc* almost flat to deeply concave or cupped, lining free hypanthium and across summit of ovary, commonly pink to red. *Fruit* indehiscent, with the hypanthium not or scarcely lengthening but becoming more swollen than in flower, 1-seeded or rarely 2-seeded, summit more or less flat; wall crustaceous or leathery, not very thick. *Seed(s)* filling available space in fruit and shaped accordingly, reaching top and usually also the base of fruit, often narrowed towards the base, usually narrowly conic to almost globular, soft, surrounded by a shiny membranous envelope that is very loose and easily dislodged.

Size and distribution. *Micromyrtus* is endemic to mainland Australia. Currently 34 species are recognised from the category revised here with the few-ribbed hypanthium, including 14 Western Australian species. This species group has two main areas of occurrence, one extending from central Australia to the south-west and the other on the eastern side of the mainland (Figure 1A). The greatest concentration of species is in south-eastern Queensland and a smaller concentration of species is found in the south-west of Western Australia.

A further four named species and six unnamed species are currently recognised at PERTH for the other main category of species, characterised by a 10-ribbed hypanthium, that is endemic to the south-west of Western Australia. This brings the total number of Western Australian species of *Micromyrtus* to 24.

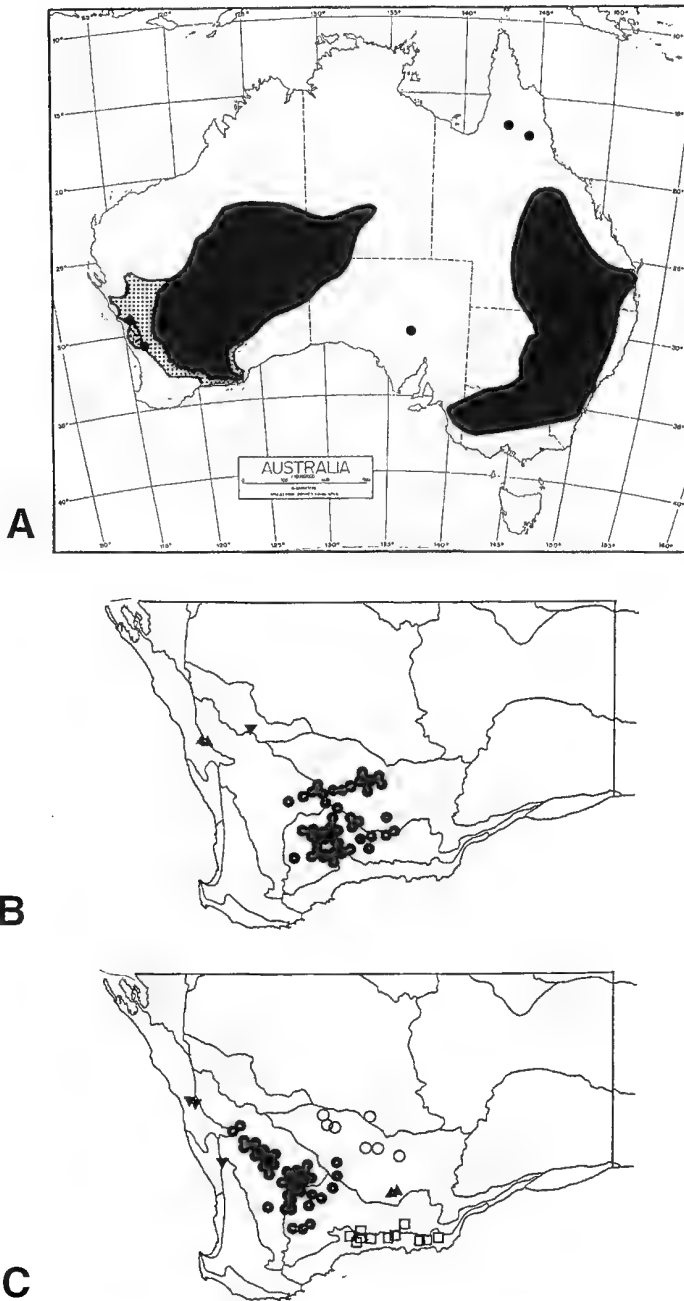


Figure 1. A – Distribution of the few-ribbed *Micromyrtus* species (black), with additional areas of distribution where only 10-ribbed taxa are known (spotted) and the distribution of *Corynanthera* (shaded) also shown; B – Distribution of *Micromyrtus erichsenii* ●, *M. ninghanensis* ▼ and *M. uniovula* ▲; C – Distribution of *M. imbricata* □, *M. obovata* ●, *M. monotaxis* ○, *M. papillosa* ▲ and *M. rogeri* ▼.

Chromosome numbers. Like most other genera in the Myrtaceae, *Micromyrtus* has a base chromosome number of $x = 11$. Chromosome numbers are known for several Western Australian species (Rye 1979) and one eastern species (Smith-White 1950). *Micromyrtus hursthousei* is tetraploid with $n = 22$ and the other species are diploid with $n = 11$. In view of the trend for low chromosome numbers in the Myrtaceae to be found in taxa with low ovule numbers (Rye & James 1992), it would be of interest to determine the chromosome numbers of the uniovulate taxa in *Micromyrtus*. The haploid chromosome numbers recorded in uniovulate members of other genera in the *Chamelaucium* alliance range from 6 to 9.

Lectotypification. Despite the relatively recent revisions of central and eastern Australian species of *Micromyrtus* (see introduction), no lectotype has been nominated for the genus. In the protologue, Bentham (1865) gave the ovule number for the genus as 2 or 4. He indicated that there were six species of *Micromyrtus* but did not list them, referring instead to his coming publication of the genus in Volume 3 of "Flora Australiensis". In that work, Bentham (1867) described the six species referred to earlier, *M. elobata*, *M. racemosa* Benth., *M. imbricata*, *M. obovata* [as *M. drummondii* nom. superf.], *M. ciliata* [as *M. microphylla* (Sieb. ex Spreng.) Benth. nom. illeg.] and *M. minutiflora* Benth., and amended his description of the genus to include a seventh species, *M. leptocalyx* Benth., with a higher ovule number of 6–8. Of the original six species, the last four listed have five antisepalous ribs on the hypanthium, and since a majority of the currently named species also have this type of ribbing it seems appropriate to choose the lectotype from among the members of this group. *Micromyrtus drummondii* is here selected as the lectotype for the genus.

Affinities. Table 1 compares the distribution and morphology of the two main categories of *Micromyrtus* species and the closely related monotypic genus *Corynanthera*. On this table the *Micromyrtus* category without antipetalous ribbing and including the type species is referred to as the 'typical group' and the other as the 'atypical group', with the only consistent difference shown being in the hypanthium ribbing. In all members of the typical group, the hypanthium has a rib or angle opposite each sepal. In most cases the hypanthium is best described as 5-ribbed (or 6-ribbed if the flowers are hexamerous) although the ribs may divide irregularly above the middle into 1 or more branches. In two eastern Australian species however, some of the ribs divide very close to the base of the flower, resulting in an irregularly 6–8(9)-ribbed hypanthium. The atypical species group is characterised by having 10 ribs, with one rib opposite each sepal and petal. However, this has become modified in one unnamed species with a very compressed hypanthium, which usually has only the 5 antipetalous ribs visible and sometimes appears to have no ribs.

Corynanthera differs in its hypanthium ribbing from both categories of *Micromyrtus*, having a variable number of obvious ribs opposite the sepals and petals, commonly with an obvious rib opposite the abaxial petal and also prominent ribs opposite three of the sepals. The more obvious stamen characters distinguishing *Corynanthera* from *Micromyrtus* are also listed on the table.

The usually 10-ribbed atypical group of *Micromyrtus* is constant in stamen and ovule number but shows variability in the persistence of the bracteoles, from caducous to remaining attached to the plant until after the fruits are shed, and in the bud apex, which varies from hemispheric to conic. In the usually few-ribbed typical group, stamen and ovule numbers are variable, but the bud apex is always hemispheric and the bracteoles are shed before the fruits mature.

Notes. The flowers are hexamerous in *Micromyrtus hexamera* and either hexamerous or pentamerous in *M. patula* A.R. Bean and *M. rotundifolia* A.R. Bean. All other species have consistently pentamerous flowers. Most eastern species and some western species have only 5 (rarely 6) stamens, one opposite each petal. The remaining species have one stamen opposite each sepal and petal giving a total of 10

Table 1. Comparison of the distribution and morphology of *Corynanthera* and the two main groups of species currently placed *Micromyrtus* with a primarily few-ribbed or 10-ribbed hypanthium respectively.

Insertion is described as equal where antipetalous and antisepalous stamens (when present) arise at the same level and unequal when the antisepalous ones are inserted distinctly lower than antipetalous ones.

	<i>Corynanthera</i>	<i>Micromyrtus</i> typical group	<i>Micromyrtus</i> atypical group
distribution	south-west of Western Australia	widespread on Australian mainland	south-west of Western Australia
bracteoles	persistent	caducous or deciduous	caducous to persistent
bud apex	hemispheric	hemispheric	hemispheric to conic
number of ribs			
antisealous	usually several	5 or 6	5 or absent
antipetalous	usually 1	absent	5
unaligned	absent	absent or several	absent
total	variable	5–8(9)	usually 10
androecium			
stamen no.	10	5–10 or 12	10
insertion	equal	equal or unequal	unequal
dehiscence	central pore	slits	slits
gland	long-stalked	sessile	sessile
ovule no.	2	1–10	2

stamens, except for the hexamerous *M. hexamera*, which has 12 stamens. *Micromyrtus erichsenii* is remarkable in showing variation in stamen number from 5 to 10, with the number of stamens in the antisealous whorl varying from 0 to 5 between or within populations and often also varying between different flowers on the same plant.

Most eastern and central Australian species of *Micromyrtus* have 4–10 ovules per flower and the remaining two species have two ovules. In contrast most south-western species have two ovules, and three new species described here have only one ovule, a new record for the genus. Normally only one seed is produced, regardless of the number of ovules present. Being dry, indehiscent and 1-seeded, the fruit is a nut. While many other genera of the *Chamelaucium* alliance also have a nut, reduction of ovule number down to one in these genera is rare, having been recorded only in a few species belonging to *Actinodium* Schauers and *Verticordia* DC.

In *Micromyrtus*, the nut is enclosed in the adnate portions of the hypanthium and disc, and is capped by the free portion of the hypanthium and the persistent sepals. Usually the petals close to an erect position after anthesis and are shed before the fruit matures. *Micromyrtus imbricata* is unusual in having persistent widely spreading petals, which presumably assist in the dispersal of the fruits.

Key to the Western Australian species of *Micromyrtus* with five antisepalous ribs or angles on the hypanthium

1. Hypanthium very compressed, with 2 abaxial, 1 adaxial and 2 lateral ribs.
Ovules 1 or (in *M. rogeri*) 2.
2. Stamens 5. Petals narrowly clawed. (Norseman area.) ***M. papillosa***
2. Stamens 10. Petals fairly broadly clawed or broad-based.
3. Leaf margins densely and finely lacinate. Sepals denticulate to lacinate.
Ovary cavity central; ovules 2. (Arrino area.) ***M. rogeri***
3. Leaf margins entire. Sepals entire. Ovary cavity terminal; ovule 1.
4. Leaves oblong-elliptic. Adnate portion of hypanthium narrowed
towards base, rounded on abaxial surface, with adaxial rib very prominent.
(Three Springs area.) ***M. uniovula***
4. Leaves obovate. Adnate portion of hypanthium the same width throughout,
almost flat on abaxial surface, with adaxial rib not prominent. (Ninghan
Station area.) ***M. ninghanensis***
1. Hypanthium terete or (in *M. stenocalyx*) somewhat compressed, with 5
uniformly spaced ribs or 5-angled. Ovules 2 or 6–10.
5. Hypanthium densely bearded and/or prominently rugose. Stamens 5.
6. Hypanthium rugose distally and densely bearded below. Style c. 2.5 mm long.
7–10. Ovules 2. (Gibson Desert.) ***M. barbata***
6. Hypanthium prominently rugose throughout. Style c. 0.5 mm long. Ovules
(Wialki to central Australia.) ***M. flaviflora***
5. Hypanthium fairly smooth apart from the 5 ribs. Stamens 5–10 in *M. erichsenii*,
10 in all other species.
7. Ovules 6–8. Central Australian.
8. Filaments filiform, less than 0.1 mm wide. Sepals with margin not recurved.
(East of Warburton.) ***M. helmsii***
8. Filaments lorate, over 0.3 mm wide. Sepals with margin strongly recurved.
9. Leaves elliptic to broadly ovate, 1–2 mm long. Sepals with large fimbriate
auricles obscuring the hypanthium. (Gibson Desert to far west of
South Australia.) ***M. fimbrisepala***
9. Leaves linear to narrowly obovate, 3–4 mm long. Sepals with small
denticulate auricles. (Cundeelee to Rawlinson Range.) ***M. hymenonema***
7. Ovules 2. South-western Australian, extending inland to Cundeelee area.
10. Hypanthium 2.5–3.5 mm long, compressed, scarcely ribbed. Sepals
rim-like, 0.1–0.2 mm long. (Rason Lake to Cundeelee area.) ***M. stenocalyx***
10. Hypanthium 0.8–2.5 mm long, not compressed, with 5 prominent ribs.
Sepals ovate to depressed ovate, (0.2)0.3–1 mm long.
11. Hypanthium ribs broad and rounded. Petals widely spreading and becoming
reddish in fruit. (Ravensthorpe to Cape Arid National Park.) ***M. imbricata***
11. Hypanthium ribs narrow, sharply angled. Petals closing to a fairly erect
position after anthesis.
12. Flowers with hypanthium 1.5–2.5 mm long and petals 1.9–2.4 mm long.
Antisepalous stamens inserted at summit of disc. (Mt Manning Range
to Comet Vale to Coolgardie.) ***M. monotaxis***
12. Flowers with hypanthium 0.8–1.6 mm long and petals 1.1–2 mm long.
Antisepalous stamens absent or inserted lower on the disc than the
antipetalous stamens.

13. Peduncles 0.5–1.5 mm long. Stamens 10. Style 0.35–0.8 mm long.
(Wubin to Lake Grace.) **M. obovata**
13. Peduncles 1.3–2 mm long. Stamens 5–10. Style 0.1–0.25 mm long.
(Merredin to Coolgardie to Newdegate to Kumarl.) **M. erichsenii**

Previously revised species

Six Western Australian species, *Micromyrtus barbata* J.W. Green, *M. fimbrisevala* J.W. Green., *M. flaviflora* (F. Muell.) F. Muell. ex J.M.Black, *M. helmsii* J.W. Green, *M. hymenonema* (F. Muell.) C.A. Gardner and *M. stenocalyx* (F. Muell.) J.W. Green, occur primarily in the Eremaean Botanical Province and have already been described and illustrated in Green (1980). Four of these taxa differ from the south-western species in having six or more ovules radially arranged around the placenta. The other two species, *M. barbata* and *M. stenocalyx*, have a 5-angled or only slightly 5-ribbed hypanthium that is not or only moderately compressed, whereas the south-western species have the hypanthium either prominently 5-ribbed or very compressed.

Micromyrtus erichsenii Hemsl., *Hooker's Icon. Pl. Ser. 4*, 8, t. 2780 (1905). *Type*: Dedari, 24 miles [39 km] west of Coolgardie, Western Australia, G.H. Thistleton-Dyer 43 (*holo*: B n.v., possibly destroyed; *iso*: PERTH (ex B) 01630784).

Illustration. Hemsley (1905: plate 2780).

Shrubs erect, 0.3–2 m high, 0.3–1.2 m diam. *Leaves* widely antrorse to almost appressed, fairly densely arranged on the smaller branchlets. *Petioles* 0.3–0.5 mm long. *Leaf blades* obovate to very broadly obovate in outline, 1.2–2.4 x 0.8–1.2 mm, very thick (almost triangular in cross-section), broadly obtuse, entire; lower surface strongly keeled, with 3–7 prominent glands up to 0.2 mm diam.; upper surface shallowly concave to convex. *Racemes* mostly extending for 3–9(15) nodes, the flowers widely antrorse or patent; peduncles 1.3–2 mm long. *Bracteoles* caducous or deciduous, rather scarious, 0.6–1 mm long, golden-brown or reddish-brown, strongly folded with a glandular keel, incurved at apex, entire. *Flowers* 3–4 mm diam.; hypanthium not compressed, 0.8–1.6 mm long, 0.3–0.5 mm wide at midpoint, 0.6–1 mm wide at summit, free in distal c. 0.2 mm, with 5 prominent narrow acute ribs, the ribs occasionally dividing into 2 branches near summit, concave between the ribs. *Sepals* fairly erect in flower and fruit, very broadly or depressed ovate, 0.2–0.6 mm long, 0.3–0.6 mm wide, white or whitish, broadly obtuse, entire or rarely somewhat denticulate. *Petals* with claw fairly erect and remainder widely spreading in flower, erect in fruit, very broadly obovate, 1.1–1.6 mm long, white or cream, sometimes red-tinged on outer surface, broadly obtuse, entire. *Stamens* 5–10, the antipetalous ones inserted inside the summit of disc and with a filament 0.2–0.35 mm long, the antisepalous ones usually absent or reduced in number, inserted distinctly within the margin of the disc and somewhat shorter than antipetalous ones. *Anthers* c. 0.2 mm long; slits oblique or rarely subparallel; gland broad at base with 2 large basal lateral lobes and a more elongate apical portion. *Ovary* with 2 ovules in a more or less terminal cavity. *Style* 0.1–0.25 mm long. *Fruit* 1.3–1.7 mm long, 0.7–1 mm wide, 1-seeded; hypanthium 5-ribbed. *Seed* truncate-obovoid, 1.1–1.4 mm long, 0.6–0.8 mm wide; enveloping membrane 5-angled, golden brown.

Selected specimens examined. WESTERN AUSTRALIA: 36 miles [58 km] S of Norseman, 15 May 1968, E.M. Bennett 2154 (MEL n.v., PERTH); 2 miles [3 km] E of Ghooli, 7 Oct. 1953, H.F. & M. Broadbent (BM); 65.2 km NE of Mukinwobert Rock, 7 Sep. 1983, M.A. Burgman 2217 & S. McNee (PERTH); Coolgardie goldfield, Oct. 1901, E. Pritzel 863 (PERTH ex B); c. 1 km SW of Digger Rocks,

6 Sep. 1996, *N. Gibson & K. Brown* 3735 (PERTH); N of Mt Day, Bremer Range, 22 Sep. 1994, *N. Gibson & M. Lyons* 1962 (PERTH); 10.5 miles [17 km] from Newdegate to Lake Grace, 14 Sep. 1971, *S. Paust* 829 (CBG n.v., PERTH); South Iron Cap, 7 Oct. 1976, *B.L. Rye* 76010 (PERTH); Great Northern Highway, 17 km E of Southern Cross, 30 Sep. 1981, *R. Spjut, G. White, R. Phillips & L. Lacy* 7255 (PERTH); 20.4 km W of Bullabulling, 1 Sep. 1982, *C.I. Stacey* 715 (PERTH).

Distribution and habitat. Occurs in the South-western Interzone and eastern parts of the South West Botanical Province: AW, COO, ESP, MAL. Recorded in a roughly square area bounded by Merredin, Coolgardie, Newdegate and Kumarl (south of Norseman). Inhabits sandplains and more clayey flats, the soil colour often yellow or brown, in shrublands or very open woodlands dominated often by mallees (*Eucalyptus*), *Allocasuarina* or *Acacia* species. (Figure 1B)

Phenology. Flowers recorded February to November, especially July to October. Fruiting closely follows flowering and mature fruits are often present on plants that also have open flowers and buds.

Chromosome number. $n = 11$ [as *Micromyrtus drummondii*], voucher *B.L. Rye* 76010 (Rye 1979).

Affinities. Previously confused with, and reduced to a synonym of, *Micromyrtus obovata*, but differing in its smaller leaves and flowers, longer peduncles, usually shorter sepals, extremely short style, shorter stamens and usually lower stamen number, often more oblique anther cells, and much greater tendency to produce fertile fruits. The two species are largely geographically separated, *M. obovata* occurring in the west and *M. erichsenii* in the east, but their ranges overlap in the Merredin to Hyden area.

Another close relative of *Micromyrtus erichsenii*, which was also previously included under *M. obovata*, is the new species *M. monotaxis* (see notes under that species). All three species have the disc relatively horizontal and prominently patterned with large low tubercles.

Notes. *Micromyrtus erichsenii* is a common and extremely variable species. Specimens from the far north of the species range vary in stamen number from 5 to 10, the type specimen being one of those with 10 stamens. Elsewhere in the species range, most specimens have regularly 5 stamens or vary from 5 to 7 stamens. In the 10-staminate flowers, the antipetalous filaments tend to be longer (0.25–0.35 mm) than those of 5-staminate flowers, which are 0.2–0.3 mm long.

In the south-eastern part of the range, especially in the vicinity of Frank Hann National Park, there are some relatively large-leaved and large-flowered specimens (e.g. *Paul G. Wilson* 5703), with petioles up to 0.5 mm long, flowers up to 4 mm in diameter and sepals up to 0.6 mm long, but these still have 5 short stamens and the extremely short style that is characteristic of the species. This variant intergrades with the more typical variant that is common in adjacent areas. Excluding the large-flowered south-eastern variant, the species has flowers 3–3.5 in diameter and sepals 0.2–0.4 mm long.

Considerable variation in growth pattern is also seen in the species, some of which must be related to the age and fire history of the plants, but a genetic component may be significant. Some of the northern specimens (e.g. *Spjut et al.* 7255) have stems much-branched and forming a shrub shape c. 0.2 m high, from which a few tall erect branches arise, extending up to a maximum of 2 m above the ground. This type of growth pattern has also been reported in *M. monotaxis* (*M. Hislop* pers. comm.) and in some less closely related species.

Field studies are needed to further elucidate the variation in *Micromyrtus erichsenii*.

Micromyrtus imbricata Benth., Fl. Austral. 3, 64 (1867). *Type*: sandy places, Termination Granite, [c. 53 km north-east of Israelite Bay, Western Australia], G. Maxwell (*holo*: K n.v.).

Illustration. Blackall & Grieve (1980: 43).

Shrub 0.2–1 m high, erect and slender to intricately branched and widely spreading. *Leaves* widely to fairly closely antrorse, densely arranged distally on the branchlets. *Petioles* 0.4–0.6 mm long. *Leaf blades* broadly to depressed obovate, 1.5–3 x 1.3–2 mm, broadly obtuse, entire, with a prominent keel at least in distal half and incurved at apex; lower surface shallowly folded-convex, with usually 4–6 prominent glands up to c. 0.2 mm diam. in each longitudinal row; upper surface slightly concave. *Racemes* mostly extending for 3–20 nodes, the flowers widely spreading and sometimes becoming pendulous in fruit; peduncles 1.2–3 mm long. *Bracteoles* caducous, with a herbaceous keel and narrow scarious incurved margins and very incurved apex, narrowly obovate to almost ovate, 0.6–2 mm long, often brown or reddish, entire, with prominent glands. *Flowers* 4–5 mm diam.; hypanthium narrowed at base to a usually distinct anthopodium, top-shaped (broadly conic) above but commonly with a somewhat rounded base, not compressed, 1.4–2 mm long (including an anthopodium up to 1 mm long), 0.6–0.8 mm wide at midpoint, 1.4–1.5 mm wide at summit, free in distal 0.3–0.4 mm, very prominently 5-ribbed, sometimes with additional intermediate ribs partially developed (at base or on free portion of hypanthium) or very rarely with some of the five ribs branching towards the top, smooth between the ribs, often glossy, the ribs usually very obtuse. *Sepals* erect to spreading in flower, erect in fruit, broadly to depressed ovate, 0.5–0.8 mm long, 0.6–1 mm wide, often pink- or red-tinged, broadly obtuse, entire or sometimes minutely toothed. *Petals* with claw erect and lamina widely spreading in flower and fruit, very broadly obovate or almost circular, 1.5–2.3 mm long, distinctly clawed at base, often pinkish or red-tinged outside, white or sometimes pale pink inside at first, becoming more pink and then reddish in fruit, broadly obtuse, entire. *Stamens* 10, the antipetalous ones inserted on inside of summit of disc, the antisepalous ones distinctly lower near middle of free tube; filament 0.3–0.5 mm long. *Anthers* c. 0.3 mm long; slits very oblique (about half way between longitudinal and transverse); gland compact and broader than long, with multiple densely packed lobes surrounding the very short apical portion. *Ovary* with 2 ovules in a terminal cavity. *Style* 0.5–1 mm long. *Fruit* broadly conic with a pinched-in base, 1.1–1.4 mm long, 1–1.3 mm wide, 1-seeded; hypanthium prominently 5-ribbed, glossy. *Seed* of approximately the same shape as the fruit including less prominent ribs, 0.9–1 mm long, 0.7–0.8 mm wide; enveloping membrane golden brown with reddish flecks.

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: corner of Melaleuca Rd and West Point Rd, 9 Sep. 1992, G.F. Craig 2026; 26.5 km SE of Scaddan, 4 Oct. 1995, R.J. Cranfield 10456; Mt Burdett, Wittenoom Hills Nature Reserve, 8 Nov. 1992, A.M. Lyne 1090, L. Craven & F. Zich (ex CBG); 35 km E of Ravensthorpe, 16 Nov. 1981, K.R. Newbey 9411; 7 km N of Mt Baring, Cape Arid National Park, 12 Oct. 1984, K.R. Newbey 9753; N of Howick Hill, 3 Oct. 1982, B.L. Rye 82026; 9 miles [14.5 km] N of Thomas River, Oct. 1933, H. Steedman; 5 km N of Dunn Swamp, c. 80 km NE of Ravensthorpe, 21 Sep. 1979, J. Taylor 741, M.D. Crisp & R. Jackson (ex CBG).

Distribution and habitat. Extends from the Ravensthorpe area east to Cape Arid National Park in the south-eastern portion of the South West Botanical Province: ESP, MAL. Commonly recorded on flat, relatively low-lying ground, in a variety of sandy soils, sometimes over granite, in shrublands often dominated by mallees (*Eucalyptus*). (Figure 1C)

Phenology. Flowers and fruits: mainly August to November.

Notes. *Micromyrtus imbricata* is a very variable species but without any obvious geographic trends among its numerous populations. Its affinities are unclear. It is the only Western Australian species to have very broad, usually rounded ribs on the hypanthium that are rather similar to the ribs found in a group of eastern Australian species including *M. ciliata*. However the *M. ciliata* group differs in a number of characters including its very short peduncles, 5 stamens and 4 ovules. *M. imbricata* also has a very compact multi-lobed gland, unlike that of the *M. ciliata* group.

***Micromyrtus monotaxis* Rye, sp. nov.**

Micromyrto obovato affinis sed floribus et pedunculis grandioribus, staminis uniseriatis supra apice vel extrinsecus apice disci, stylo filamentis distincte breviora differt.

Typus: on north side of track between Kurrajong and Pittosporum rockholes, c. 17.2 km north-north-west of Mt Dimer, Hunt Range, Jaurdi Station, Western Australia, 18 July 1995, *N. Gibson & M. Lyons* 3706 (*holo:* PERTH 05323509; *iso:* CANB, MEL).

Shrubs erect, moderately dense, (0.3)0.7–1.6 m high, up to 1.6 m diam. *Leaves* widely to closely antrorse, densely arranged on the smaller branchlets. *Petioles* 0.3–0.4 mm long. *Leaf blades* obovate to very broadly obovate in outline, 1.7–3.5 x 1.3–1.5 mm, very thick (almost triangular in cross-section), broadly obtuse, entire or denticulate; lower surface strongly keeled, with 3–6 prominent glands up to 0.2 mm diam.; upper surface shallowly concave to convex. *Racemes* mostly extending for 2–8 nodes, the flowers widely antrorse or patent; peduncles 1–2.5 mm long. *Bracteoles* caducous and rarely seen, rather scarious, strongly folded with a glandular keel, up to 1.3 mm long, incurved at apex, entire. *Flowers* 4.5–6 mm diam.; hypanthium not compressed, 1.5–2.5 mm long, c. 0.6 mm wide at midpoint, c. 1.3 mm wide at summit, free in distal c. 0.3 mm, with 5 prominent narrow acute ribs, concave between the ribs. *Sepals* fairly erect in flower and fruit, somewhat scarious, almost square to depressed ovate, 0.5–1 mm long, 0.6–1.3 mm wide, white, broadly obtuse, entire or denticulate. *Petals* with claw fairly erect and remainder widely spreading in flower, becoming erect and eventually shed from mature fruit, very broadly obovate, 1.9–2.4 mm long, white, broadly obtuse, entire or denticulate. *Stamens* 10, inserted more or less at the same height on the outside or on the summit of disc, the antipetalous ones usually distinctly outside the disc; filament 0.6–0.9 mm long. *Anthers* c. 0.25 mm long; slits subparallel (slightly oblique but much closer to longitudinal than transverse); gland broad at base with 2 large lateral lobes, with a more elongate apical portion. *Ovary* with 2 ovules in a more or less terminal cavity. *Style* 0.3–0.5 mm long. *Fruit* c. 1.8 mm long, c. 1.3 mm wide, 1-seeded; hypanthium 5-ribbed. *Seed* obovoid (with base very narrow), c. 1.5 mm long, c. 0.9 mm wide; enveloping membrane 5-angled, golden brown. (Figure 2A–D)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: 4.3 km NE of main road, 1 km N of Comet Vale, 16 June 1988, *R.J. Cranfield* 7036; 10 km E of Bullabulling, 23 Aug. 1995, *R. Davies* 59; between Die Hardy Range and Mt Manning Range, 17 Mar. 1978, *A.S. George* 15123; Coolgardie, Oct. 1900, *E. Kelso*; 9 km NW of Stewart, c. 75 km WNW of Coolgardie, 26 Aug. 1981, *K.R. Newbey* 8701; 15 km NE of Bungalbin Hill, 1 Dec. 1981, *K.R. Newbey* 9435; 14 km NE of Bungalbin Hill, 23 Sep. 1981, *K.R. Newbey* 8990; 11 miles [18 km] from Coolgardie towards Southern Cross, 5 Sep. 1968, *M.E. Phillips* (ex CBG).

Distribution and habitat. Occurs in the Eremaean Botanical Province and South-western Interzone, extending from near Die Hardy Range east to Comet Vale and south-east to Coolgardie: COO, MUR.

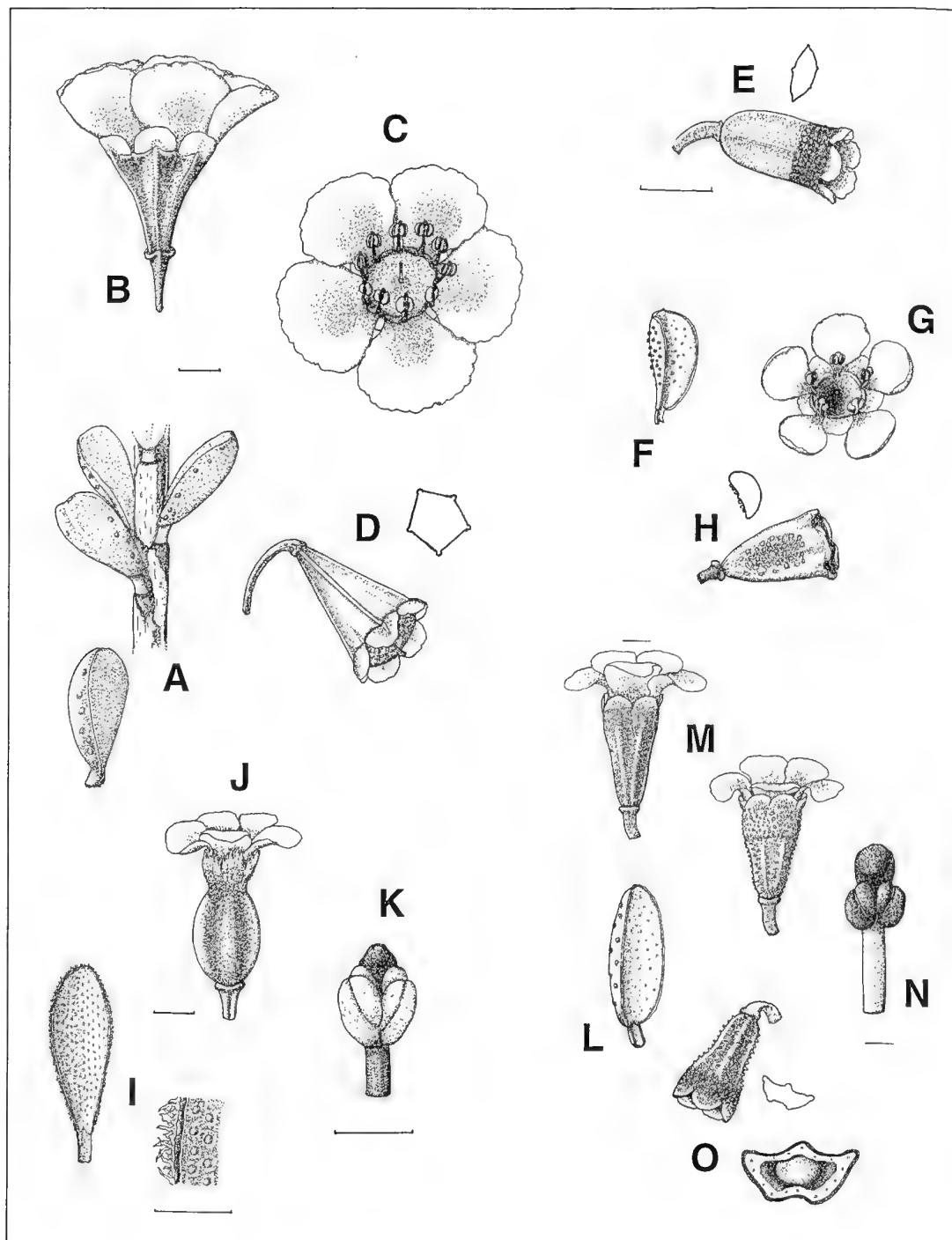


Figure 2. A–D. *Micromyrtus monotaxis*. A – leaves, B – side view of flower, C – top view of flower, D – fruit (with TS); E – *M. ninghanensis*, adaxial view of fruit (with TS); F–H. *M. papillosa*. F – leaf, G – top view of flower, H – adaxial view of fruit (with TS); I–K. *M. rogeri*. I – leaf with margin enlarged; J – adaxial view of flower, K – stamen; L–O. *M. uniovula*. L – leaf, M – abaxial view of two flowers, N – stamen, O – adaxial view of fruit with TS showing immature seed. Scale bars 0.5 mm for stamens (K,N), 1 mm elsewhere. Drawn by Lorraine Cobb from C.A. Gardner 13469 (A,D), R.J. Cranfield 7036 (B,C), R.J. Cranfield 8619 (E), R.J. Cranfield 741 (F,G), D.J.E. Whibley 4580 (H), M.A. Langley & J.K. Harvey 1875 (I–K), L. Polomka & S.J. Patrick 3307 (L–N) and R.J. Cranfield 7903 & P.J. Spencer (M,O).

Recorded mainly from yellow sandplains, also recorded from reddish soil near Comet Vale, in shrublands dominated by a variety of species including *Callitris preissii*. (Figure 1C)

Phenology. Flowers: March to December, especially August to October. Only one specimen (C.A. Gardner 13469) was in mature fruit, and this had good seed set as in *M. erichsenii*. It was collected in early September from Comet Vale.

Etymology. From the Greek *monos* – single and *taxis* – row, referring to the arrangement of all the stamens at the summit of the hypanthium, rather than having the antisepalous ones inserted at a distinctly lower position than the antipetalous ones. This character distinguishes the species from its two closest relatives.

Affinities. Closely related to *Micromyrtus erichsenii* and *M. obovata*, both of which tend to have shorter or less bulky leaves and smaller flowers. In these two species the antisepalous stamens are either absent or inserted in a different position from the antipetalous ones. *Micromyrtus erichsenii* also differs from *M. monotaxis* in its shorter style and stamens, and usually has fewer stamens with the anther cells more oblique. *M. obovata* tends to have shorter peduncles, more numerous flowers, and its style longer and more similar in length to the filaments, not distinctly shorter than the filaments as in *M. monotaxis*.

Micromyrtus monotaxis occurs mainly north-east of the range of *M. erichsenii* but the two taxa show a slight overlap in range. No intermediates are known. *M. monotaxis* occurs further inland, and is geographically separated from, *M. obovata*. The three species show considerable overlap in flowering time and no great differences in soil and landform preferences, although *M. obovata* appears to occur more frequently on hills and in gravelly soil than do the other two species.

Notes. All stamens are inserted at the summit of the hypanthium but the antisepalous stamens often appear to be inserted slightly differently from the antipetalous stamens, at the summit of a dip in the disc, which appears shallowly lobed, rather than distinctly outside the disc as in the antipetalous stamens. One of the flowers on R.J. Cranfield 7036 was observed to have 11 stamens rather than the normal 10.

Micromyrtus ninghanensis* Rye, *sp. nov.

Micromyrto uniovulo multo affinis sed foliis maturibus tenuioribus et obovatus, hypanthii basi magis rotundata, costa adaxiali minus prominenti differt.

Typus: Ninghan area [precise locality withheld], Western Australia, 24 October 1984, M.G. Corrick 9332 (*holo:* PERTH 02422417; *iso:* MEL *n.v.*).

Shrub low and spreading, up to 0.4 m high. *Leaves* antrorse, densely arranged distally on the branchlets. *Petioles* 0.4–0.5 mm long. *Leafblades* narrowly to broadly obovate, 2.2–3.7 x 1.1–1.4 mm, broadly obtuse, more or less entire; lower surface convex, with 4–6 prominent glands up to c. 0.1 mm diam. in each longitudinal row; upper surface concave. *Racemes* mostly extending for 2–15 nodes, the flowers antrorse to patent; peduncles 0.7–0.8 mm long. *Bracteoles* caducous or deciduous, scarious, ovate, c. 1 mm long, usually rather dark red-brown, acute, entire. *Flowers* 3–3.5 mm diam.; hypanthium very dorsiventrally compressed in adnate part, the free portion more open, depressed-conic with a rounded base, c. 1.8 mm long, c. 1.2 mm wide, free in distal 0.5–0.7 mm, not very prominently 5-ribbed, with 2 abaxial, 1 adaxial and 2 lateral ribs, the lateral ribs tending to be better defined than the other ribs, convex and usually fairly smooth but with prominent oil glands on abaxial surface, concave to flat and

usually minutely papillose on adaxial surface, the papillae less than 0.05 mm long. *Sepals* erect in flower and fruit, scarious, very depressed ovate, 0.2–0.35 mm long, 0.5–0.6 mm wide, pale brownish throughout or darker and with a pale margin, very broadly obtuse, entire. *Petals* widely spreading in flower, becoming erect then shed in fruit, broadly or very broadly obovate, 1.3–1.6 mm long, distinctly clawed at base, white, broadly obtuse, entire. *Stamens* 10, all about equal, the antipetalous ones inserted on summit of disc and somewhat exserted, the antisepalous ones inserted near middle of free tube and included; filament 0.3–0.4 mm long. *Anthers* 0.3–0.35 mm long; slits oblique (often almost transverse); gland very broad and extending laterally beyond the cells, 3-lobed, the 2 large lateral lobes of a similar size to apical portion. *Ovary* with a solitary ovule in a more or less terminal cavity. *Style* c. 0.35 mm long. *Fruit* very compressed, rectangular with rounded base, c. 1.3 x 0.9–1 mm; hypanthium c. 2 mm long, adaxial surface usually papillose. *Seed* very compressed, c. 1.1 x 0.7 mm, with summit fairly truncate and base rounded; enveloping membrane medium brown. (Figure 2E)

Other specimens examined. WESTERN AUSTRALIA: type locality, 7 Sep. 1973, J.S. Beard 6452 (PERTH); type locality, 21 Nov. 1992, R.J. Cranfield 8619 (PERTH).

Distribution and habitat. Apparently restricted to the Ninghan area in the Eremaean Botanical Province: YAL. Occurs on a greenstone-granite hill, in reddish or brown clay, in a low open woodland of *Acacia* and *Casuarinaceae*. (Figure 1B)

Phenology. Flowers: September to late October. Fruits recorded late October to November.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Known from only one locality.

Etymology. The specific epithet refers to the occurrence of the taxon in the Ninghan Station area.

Notes. Previously known informally as *Micromyrtus* sp. Ninghan (M.G. Corrick 9332). The differences between this species and its closest relative *M. uniovula* are noted under the latter species. *Micromyrtus ninghanensis* has been confused with *M. papillosa*, another species with only one ovule in the ovary. *M. papillosa* differs in its longer pedicels, more narrowly clawed petals, more papillose hypanthium and five stamens, apparently also tending to be a more erect plant with narrower leaves.

Micromyrtus obovata (Turcz.) J.W. Green, Census Vasc. Pl. W. Austral. 2 edn, 6 (1985). – *Thryptomene obovata* Turcz., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 10: 322 (1852). *Type:* south-western Australia, [Western Australia], 1847–1849, J. Drummond coll. 5 suppl., n. 23 (*holo:* KW n.v., photograph PERTH; *iso:* K n.v., PERTH 01829548, 01828564).

Micromyrtus drummondii Benth. nom. superfl., Fl. Austral. 3: 64–65 (1867). – *Thryptomene drummondii* (Benth.) F. Muell., Syst. Census Austral. Pl. 53 (1882). *Type:* south-western Australia, [Western Australia], 1847–1849, J. Drummond coll. 5 suppl., n. 23 (*holo:* K n.v.; *iso:* KW n.v. (photograph PERTH), PERTH 01829548, 01828564).

Illustration. Blackall & Grieve (1980: 43).

Shrubs erect, 0.4–1.6 m high, up to at least 1 m diam., often with numerous stems from the base

forming a dense growth habit. *Leaves* widely antrorse to appressed, fairly densely arranged on the smaller branchlets. *Petioles* 0.3–0.5 mm long. *Leaf blades* obovate to very broadly obovate in outline, 1.5–3(3.8) x 0.8–1.4 mm, very thick (almost triangular in cross-section), broadly obtuse, entire; lower surface strongly keeled, with 4–6 prominent glands up to 0.2 mm diam.; upper surface concave to convex. *Racemes* mostly extending for 6–20 or more nodes, the flowers widely antrorse or patent; peduncles 0.5–1.5 mm long. *Bracteoles* caducous to fairly persistent, rather scarious, strongly folded with a glandular keel, 0.9–1.4 mm long, incurved at apex, often red-tinged distally, entire. *Flowers* 4–5 mm diam.; hypanthium not compressed, 1.2–1.5 mm long, 0.5–0.7 mm wide at midpoint, 1–1.3 mm wide at summit, free in distal 0.2–0.4 mm, with 5 prominent narrow acute ribs, concave between the ribs. *Sepals* fairly erect in flower and fruit, somewhat scarious, ovate or elliptic to depressed ovate, 0.4–0.7 mm long, 0.5–1 mm wide, white, broadly obtuse, entire or finely denticulate. *Petals* with claw fairly erect and remainder widely spreading in flower, erect in fruit then eventually shed, very broadly obovate, 1.5–2 mm long, white, broadly obtuse, entire to shortly and finely fimbriate. *Stamens* 10, the antipetalous ones inserted on inside or on the summit of disc and with a filament (0.4)0.5–0.8 mm long, the antisepalous ones slightly shorter, inserted lower down on disc. *Anthers* c. 0.25 mm long; slits subparallel (slightly oblique but much closer to longitudinal than transverse); gland broad at base with 2 large lateral lobes, with a more elongate apical portion. *Ovary* with 2 ovules in a terminal cavity. *Style* (0.35)0.5–0.8 mm long. *Fruit* 1.3–1.4 mm long, 0.9–1.2 mm wide, usually failing to set seed, 1-seeded when fertile; hypanthium 5-ribbed. *Seed* truncate-obovoid, c. 1.2 x 0.7 mm; enveloping membrane somewhat 5-angled, golden brown.

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Nature Reserve 28715, 20 km N of Hyden, 6 Sep. 1984, J.M. Brown 142 (also CANB *n.v.*); Schillings remnant, 3 km W of Totadgin Rd on Fuschbichler Rd, Bruce Rock area, 14 Aug. 1998, J. Buegge D69; B.J. Conn 2267 & B.C. Conn (ex NSW); Boucher Rd, 1 km W of Manual Rd, Wubin area, 27 Aug. 1998, R. Davis 6515; 6.2 km S of Lake Grace, 2 Sep. 1991, C.I. Stacey 728 (also CBG *n.v.*); 6.4 km N of Muntadgin, 3 Sep. 1991, C.I. Stacey 733; 0.5 km S of Burakin and then 0.4 km NE along a track, 31 Aug. 1975, M.E. & M.E. Trudgen 1427 (also CBG, K, MEL *n.v.*); 17 km N of Kondinin, 21 Sep. 1964, Paul G. Wilson 3441 (also AD *n.v.*).

Distribution and habitat. Occurs in the South West Botanical Province and South-western Interzone, extending from Wubin south-east to the Lake Grace area and inland to near Parker Range (south of Southern Cross): AW, COO, MAL. Occurs in yellow or brownish sandy soils, often with gravel, sometimes with clay, on hills or hillsides or on flat ground, in low shrublands to woodlands commonly dominated by species of *Allocasuarina*, *Acacia*, *Eucalyptus*, *Melaleuca* or *Hakea*. (Figure 1C)

Phenology. Flowers: July to September. Despite the large number of specimens with older fruits present, these were nearly always undeveloped (i.e. not swollen) and mature seeds were observed only on G. Perry 536. The only other specimen (E.J. Croxford 2081) with swollen mature fruits had its seeds apparently late-aborted.

Affinities. See notes under its closest relatives *M. erichsenii* and *M. monotaxis*. In comparison with those two species, *M. obovata* tends to have shorter peduncles, more numerous flowers and a more exposed stigma. The longer style of this species in comparison with its relatives may be an indication of a greater adaptation for outbreeding, which may be related to its reduced fecundity. From the very few mature fruits that have been observed, *M. obovata* appears to have a fruit that is more top-shaped than that of *M. erichsenii*, with a broader summit, but more observations are needed to check this character.

Notes. Bentham (1867) described the stamens as five for this species (under his *Micromyrtus drummondii*) although it regularly has 10 stamens. Perhaps Bentham was including 5-staminate material of *M. erichsenii* under this taxon although he did not cite any collections other than the type of *M. obovata*.

A great majority of the specimens have a style 0.5–0.8 mm long. In the central wheatbelt there are also a few specimens with a style 0.35–0.45 mm long, intermixed with specimens with a longer style.

Micromyrtus papillosa* J.W. Green ex Rye, *sp. nov.

Bracteolae deciduae. Alabastri apex hemisphericus. Hypanthium c. 2 mm longum, parte inferiore dorsiventraliter compressum, pagina adaxiali papillata. Sepala erecta, petalis multo breviora, integra. Petala anguste unguiculata, alba, in fructu decidua. Stamina 5, breviora. Ovulum 1.

Typus: Beacon Hill, Norseman, Western Australia, 4 September 1968, *M.E. Phillips* (*holo:* PERTH (ex CBG) 01630822; *iso:* CBG 025387 *n.v.*).

Shrub erect but often low and spreading, 0.4–1.2 m high, 0.4–1.5 m wide. *Leaves* antrorse, densely arranged distally on the branchlets. *Petioles* 0.4–0.6 mm long. *Leafblades* obovate, broadly obovate, or occasionally obcordate, 1.5–3.5 x 1.4–1.7 mm, broadly obtuse or occasionally emarginate, entire or almost so; lower surface convex, with 8–12 prominent glands up to c. 0.1 mm diam. in each longitudinal row; upper surface concave. *Racemes* mostly extending for 5–20 nodes, the flowers usually widely antrorse; peduncles 0.4–0.6 mm long. *Bracteoles* deciduous, scarious, ovate or broadly ovate, 0.6–1 mm long, usually pale brown, acute, entire. *Flowers* 3–4 mm diam.; hypanthium very dorsiventrally compressed in adnate part, the free portion more open, depressed-conic with a rounded base, c. 2 mm long, c. 1.2 mm wide, free in distal 0.4–0.5 mm, scarcely ribbed or somewhat 5-ribbed, with 2 abaxial, 1 adaxial and 2 lateral ribs, glossy, abaxial surface fairly smooth but with the prominent oil glands sometimes protruding as short papillae, adaxial surface concave and prominently papillose, the papillae c. 0.1 mm long. *Sepals* erect in flower, erect to closed inwards in fruit, somewhat scarious, very broadly or depressed ovate, 0.3–0.5 mm long, 0.5–0.7 mm wide, green to deep red-brown with a white margin, broadly obtuse, entire. *Petals* widely spreading in flower, becoming erect then shed in fruit, broadly or very broadly obovate, 1.3–1.6 mm long, distinctly clawed at base, white, broadly obtuse, entire. *Stamens* 5, inserted at summit of disc; filament 0.35–0.5 mm long. *Anthers* 0.2–0.25 mm long; slits very oblique; gland simple. *Ovary* with a solitary ovule in a more or less terminal cavity. *Style* c. 0.5 mm long. *Fruit* compressed, with a rounded base, not seen at maturity; abaxial surface of hypanthium smooth, glossy, prominently gland-dotted; adaxial surface of hypanthium prominently papillose, glossy. (Figure 2F–H)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Mt Norcott, '10 km E' [c. 20 km ENE] of Norseman, 22 Sep. 1978, *R.J. Cranfield* 741; Jimberlana Hill, NE of Norseman, 20 Apr. 1997, *R. Davis* 3056; summit of Jimberlana Hill, 15 Apr. 1995, *B.J. Lepschi & T.R. Lally* 1809; Jimberlana Hill, 2 Oct. 1979, *K.R. Newbey* 6163 (also CANB *n.v.*); near base of Jimberlana Hill, 20 Aug. 1980, *K.R. Newbey* 7184; 5 miles [8 km] N of Norseman, 8 Aug. 1951, *R.D. Royce* 3473; c. 8 km NE of Norseman, 29 Oct. 1974, *D.J.E. Whibley* 4580 (also AD *n.v.*).

Distribution and habitat. Restricted to the Norseman area in the South West Botanical Province: YAL. Occurs on hills, from near the base to the summit, in sandy or clay soil with ironstone or granite rocks or slabs. (Figure 1C)

Phenology. Flowers: August to early October, also recorded April. Fruits: recorded in October.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Recorded from three hills within a range of less than 30 km and not known from any conservation reserves.

Etymology. The specific epithet refers to the papillose hypanthium.

Notes. Its closest relatives are the other two uniovulate species, *Micromyrtus ninghanensis* and *M. uniovula*, both of which differ in having 10 stamens, less prominent papillae on the hypanthium and less strongly clawed petals. The strongly clawed petals of *M. papillosa* seem unusual in the genus.

Micromyrtus rogeri J.W. Green ex Rye, *sp. nov.*

Bracteolae deciduae. Folia juvenia dense ciliata. Alabastri apex hemisphericus. Hypanthium 2–2.5 mm longum, parte inferiore dorsiventraliter compressum, costis 2 abaxialibus, 1 adaxialibus et 2 lateralibus. Sepala erecta, petalis multo breviora, manifeste denticulata usque laciniata. Petala alba, in fructu decidua. Stamina 10, maxime breviora, filamentum anthera breve. Ovula 2.

Typus: 18–20 miles [29–32 km] west-north-west of Arrino, Western Australia, 22 July 1980, *R. Hnatiuk* 800019 (*holo:* PERTH 01631306; *iso:* CANB, K, NSW all *n.v.*, PERTH 01631314).

Shrubs 0.2–0.4 m high, with multiple erect stems from a lignotuber. *Leaves* antrorse to appressed, fairly densely arranged distally on the stems. *Petioles* 0.5–0.6 mm long. *Leaf blades* obovate, 3–4.5 x 2–2.5 mm, broadly obtuse, with a white, densely and finely lacinate margin at first, the white margin tending to be shed in older leaves but more persistent towards the base; lower surface convex, with 8–10 prominent glands up to 0.1 mm diam. in each longitudinal row; upper surface concave. *Racemes* mostly extending for 3–8 nodes, the flowers antrorse; peduncles 0.8–1.3 mm long. *Bracteoles* deciduous, scarious, narrowly ovate or ovate, c. 2 mm long, pale brown, acute to acuminate, prominently denticulate. *Flowers* c. 3.5 mm diam., with faint fragrance; hypanthium very dorsiventrally compressed in adnate part, the free portion more open, compressed-urceolate, 2–2.5 mm long, c. 1.5 mm wide at midpoint of swollen base, c. 1 mm wide at neck and c. 1.3 mm at summit, free in distal 0.7–1 mm, somewhat 5-ribbed, with 2 abaxial, 1 central adaxial and 2 lateral ribs, somewhat concave on adaxial surface, smooth and glossy at first but apparently becoming duller and somewhat papillose in young fruit. *Sepals* fairly erect in flower and fruit, scarious, broadly or very broadly ovate, 0.4–0.5 mm long, 0.4–0.6 mm wide, broadly obtuse, prominently denticulate to lacinate. *Petals* with base erect and remainder widely spreading in flower, becoming erect then shed in fruit, broadly or very broadly obovate, c. 1.5 mm long, white, broadly obtuse, more or less entire. *Stamens* 10, with the 5 antipetalous ones at the throat and distinctly higher than the 5 included antisepalous ones; filament 0.2–0.25 mm long, shorter than or as long as the anther. *Anthers* c. 0.45 mm long in antipetalous and c. 0.35 mm long in antisepalous stamens; slits oblique (somewhat closer to longitudinal than to transverse); gland larger and with more prominent lateral lobes on antisepalous stamens, the large apical portion globular. *Ovary* with 2 ovules in an almost central cavity. *Style* c. 0.5 mm long. *Fruit* not seen at maturity, compressed-urceolate; hypanthium very compressed and with ribs no longer evident on the two surfaces, somewhat to prominently papillose. (Figure 2I–K)

Other specimens examined. WESTERN AUSTRALIA: 4.5 km at 115 degrees from junction of West Koojan Rd and The Midland Rd, 13 Nov. 1990, *E.A. Griffin* 6116 (PERTH); Mt Adams block, Quadrant

13, 1.2 km W of Natta Rd, 3.7 km S of Carey Rd, Shire of Three Springs, 14 Oct. 1998, *M.A. Langley & J.M. Harvey* 1875 (PERTH).

Distribution and habitat. Endemic to the South West Botanical Province, recorded from the Mt Adams area (west of Arrino) and from near Koojan: GS, JF. Recorded from the upper slopes of breakaways, one record in yellow-brown sandy soil, the other two records in heavier soils with lateritic gravel. The vegetation was recorded either as open heath (two records) or very open shrub mallee over open low scrub. (Figure 1C)

Phenology. Flowers: July to October. Fruits recorded in October and November.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Known from only three collections, at least one of them on private property. Two are in close proximity in the north and the other locality is well isolated, c. 170 km further south.

Etymology. Named in honour of Roger Hnatiuk, a biologist who was the first known collector of this species.

Notes. A very distinctive species, with a hypanthium similar to that of the three univulate species of *Micromyrtus* in being papillose and very compressed but differing in having a constriction towards the summit. *M. rogeri* is readily distinguished from other south-western species by its white lacinate leaf margins, and it has extremely short stamens with the very reduced filament usually shorter than the length of the anther.

More material is needed, particularly in mature fruit, to describe the species fully. The largest immature seed observed in the material available was c. 1.4 mm long.

Micromyrtus uniovula* Rye, *sp. nov.

Bracteolae caducae vel deciduae. Alabastris apex hemisphericus. Hypanthium 2–2.3 mm longum, ex parte inferiore, dorsiventraliter compressum, costis 2 abaxialibus, 1 adaxialibus et 2 lateralibus, interdum minute papillatum. Sepala erecta, petalis multo brevioribus, integra. Petala alba, in fructu decidua. Stamina 10, obdiplostemonia, brevissima. Ovulum 1.

Typus: on both sides of Bunny Rd, 4 km N of Nebru Rd, Western Australia, 21 October 1999, *L. Polomka & S.J. Patrick* 3307 (*holo:* PERTH 05541719; *iso:* CANB, K, MEL).

Shrub low and spreading to fairly erect, up to 0.4 m high. *Leaves* antrorse to almost patent, rather densely arranged distally on the branchlets. *Petioles* 0.3–0.5 mm long. *Leaf blades* narrowly to very broadly oblong-elliptic, 1.5–4.5 x 1–2 mm, thick, broadly obtuse, entire or almost so; lower surface convex and sometimes indented along midvein, with 5–8 prominent glands up to c. 0.1 mm diam. in each longitudinal row; upper surface concave. *Racemes* extending for up to c. 30 nodes, the flowers usually widely antrorse, tending to become patent or pendulous in fruit; peduncles 0.5–0.7 mm long. *Bracteoles* caducous or deciduous, scarious, ovate, 0.7–1.2 mm long, pale brown, acute, entire. *Flowers* c. 3 mm diam.; hypanthium somewhat to very dorsiventrally compressed in adnate part, somewhat narrowed towards base, 2–2.3 mm long, c. 1.3 mm wide at summit, free in distal 0.6–0.7 mm, distinctly 5-ribbed, with 2 abaxial, 1 adaxial and 2 lateral ribs, the adaxial surface with its central rib more or less level with

lateral ribs but somewhat to strongly indented in between the ribs (the margins of the hypanthium often strongly incurved), minutely papillose to almost smooth (but with somewhat protruding oil glands) on both surfaces, the papillae c. 0.05 mm long. *Sepals* erect in flower and fruit, scarious at least on the margin, depressed ovate, 0.3–0.4 mm long, 0.5–0.6 mm wide, pale brownish or darker with a pale margin, very broadly obtuse, entire. *Petals* widely spreading in flower, becoming erect then shed in fruit, broadly or very broadly obovate, c. 1.3 mm long, distinctly clawed at base, white, broadly obtuse, entire. *Stamens* 10, the antipetalous ones inserted on summit of disc and slightly exserted, the antisepalous ones inserted about half way down the free tube and reaching the throat of flower; filament c. 0.4 mm long. *Anthers* c. 0.35 mm long; slits very oblique (often almost transverse); gland very broad and extending laterally beyond the cells, 3-lobed, with 2 large lateral lobes of a similar size to apical portion. *Ovary* with a solitary ovule in a more or less terminal cavity. *Style* c. 0.4 mm long. *Fruit* not seen at maturity but apparently not as compressed as in *Micromyrtus ninghanensis*, the most mature seen c. 1.8 mm long; hypanthium often somewhat papillose. (Figures 2L–O, 3)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: 4 km N of junction of Three Springs West Rd with Eneabba–Mingenew road, 21 Oct. 1982, J. Coleby-Williams 269; 2 km W along Thomas Rd, SW of Three Springs, 26 Sep. 1990, R.J. Cranfield 7885 & P.J. Spencer; 2.5 km E along Nebru Rd from intersection of Arrino South Rd, 8.5 km W of Three Springs, 2 Oct. 1990, R.J. Cranfield 7903 & P.J. Spencer; 3 km N of the Three Springs West Rd along the Mingenew–Eneabba road, 2 Oct. 1981, L.A. Craven & C. Chapman 6873 (also CANB *n.v.*); Bunney Rd, 4 km N of Nebru Rd, 2 Dec. 1999, S.J. Patrick 3359; on Bunny Rd, 4.3 km N of Nebru Rd, just S of Robinson Rd, 22 Oct. 1999, L. Polomka & S.J. Patrick 3307; 8.6 miles [13.8 km] SW of Three Springs on road to Eneabba, 10 Sep. 1978, M.E. Trudgen 2200 (also CANB, K *n.v.*).

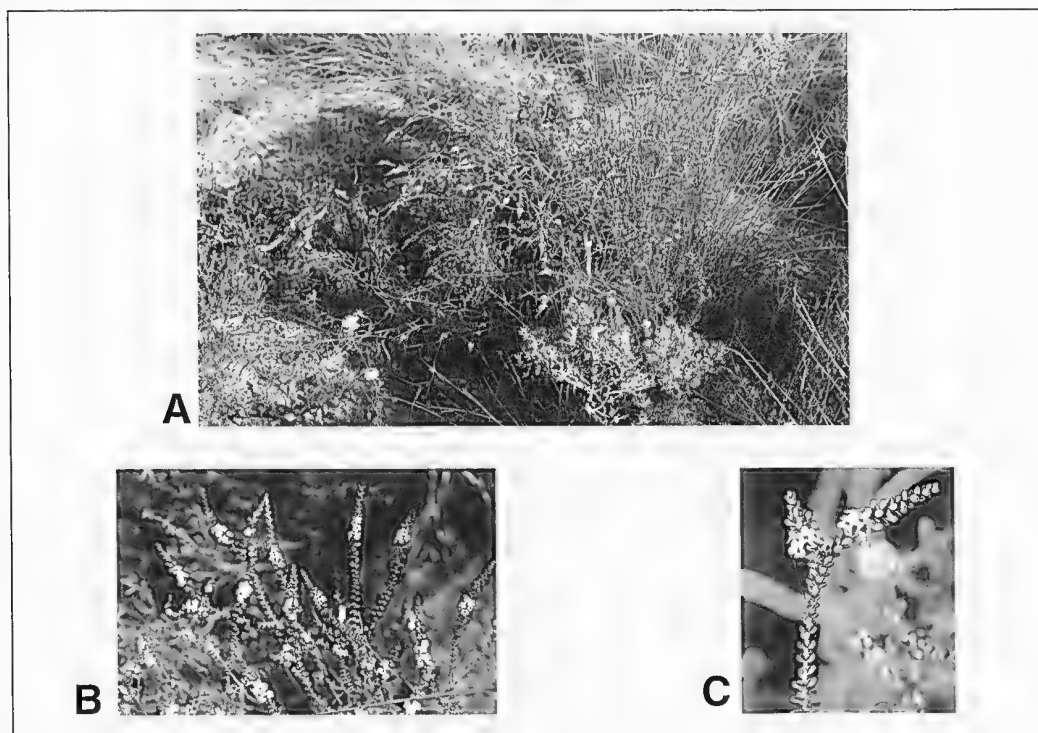


Figure 3. Photographs of *Micromyrtus uniovula* taken at the type locality by S. Patrick. A – whole plant; B – flowering stems; C – flowers.

Distribution and habitat. Endemic to the South West Botanical Province, restricted to a small area west of Three Springs: AW, GS. Occurs on lateritic rises, in sandy soil over laterite. (Figure 1B)

Phenology. Flowers: September to November. Fruits: October to December.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. This taxon is known from about eight collections over a geographical range less than 15 km long.

Etymology. From the Latin *unus* – one and *ovum* – egg, this apparently being the most common of three new taxa described here that have only one ovule in the ovary. All previously described species of *Micromyrtus* have 2–10 ovules.

Notes. Previously known by two informal names, *Micromyrtus* sp. Arrowsmith River (L.A. Craven 6873 & C. Chapman) and *Micromyrtus* sp. Three Springs (R.J. Cranfield 7885).

This species is very closely related to *Micromyrtus ninghanensis*, differing in its oblong-elliptic rather than obovate leaves and longer flowers, with the hypanthium less compressed, more narrowed at the base and with a more prominent adaxial rib. Its fruit and seed are apparently much less compressed but good fruiting material is needed to confirm this difference between the two species. The two taxa are allopatric, with *M. uniovula* occurring in lateritic habitats and *M. ninghanensis* occurring c. 150 km further inland on volcanic rocks.

Micromyrtus uniovula is also closely related to *M. papillosa* but differs in its shorter pedicels, less strongly clawed petals and ten stamens.

Discussion

The eastern species of *Micromyrtus* have been classified informally as belonging to the '*Micromyrtus ciliata* group' (revised by Green 1983b), '*M. leptocalyx* group' and '*M. hymenonema* group' (see Bean 1996). These are all subgroups of the few-ribbed category of species revised in this paper. The first two of these subgroups are restricted to eastern Australia, while the third extends to the arid zone of Western Australia. Further subgroups could be recognised in Western Australia, including one for the three very closely related species that were previously combined under the name *M. obovata*. Unlike the eastern subgroups, this western subgroup has a constant ovule number of two.

Green (1983b: 317, 329) indicated that there was greater diversity among Western Australian than eastern species of *Micromyrtus*, and recognised four informal sections for the western species, two of them with five stamens and two with ten stamens. One of his 5-staminate sections comprised the two species *Micromyrtus flaviflora* and *M. barbata*, and the other consisted of a single unnamed species that is described here as *M. papillosa*. Green did not list any species for his 10-staminate sections, which he described as having "a narrow-cylindrical floral tube", although the 10-staminate species show a much greater variation in their hypanthium shape than this suggests. A strict division into 5- and 10-staminate sections is not supported by the present study, in which the 5-staminate *M. papillosa* is considered to be closely related to three other new species that are all 10-staminate. The *M. obovata* subgroup also precludes a strict division into 5- and 10-staminate sections in Western Australia, since it includes the 5–10-staminate *M. erichsenii*.

More work is needed to determine how many infrageneric groups should be recognised in Western Australia, and how many south-western taxa with a ten-ribbed hypanthium should be recognised. The most difficult species complex is the one including *Micromyrtus racemosa* Benth. Two of the varietal manuscript names that have been applied to this species, *M. racemosa* var. *carinata* J.W. Green ms. and *M. racemosa* var. *latifolia* J.W. Green ms., clearly belong to a separate species, but the status of the many other variants in this complex has yet to be determined.

Acknowledgements

I am grateful to Peter Wilson for providing details of the preliminary findings of his molecular data on *Micromyrtus* and related genera, Paul Wilson for translating the diagnoses into Latin, Malcolm Trudgen for his advice regarding species limits in *Micromyrtus*, Sue Patrick for providing information on species with conservation priority and photographs, and Lorraine Cobb for the fine illustration.

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***Scaevola ballajupensis* (Goodeniaceae), a new species from the Jarrah forest of south-western Australia**

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Abstract

Sage, L.W. *Scaevola ballajupensis* (Goodeniaceae), a new species from the Jarrah forest of south-western Australia. *Nuytsia* 15(1): 123–126 (2002). The new species *Scaevola ballajupensis* L.W. Sage, from the south-western Australian Jarrah forest, is described and photographically illustrated. The species is known only from one locality on private property and therefore has a high conservation priority. An amendment to the key to *Scaevola* species in “Flora of Australia” is made to include the new taxon and a table showing how it differs from its closest relatives is provided.

Introduction

A new species of *Scaevola* L. (Goodeniaceae), recently discovered during a flora survey undertaken by members of the Bridgetown Regional Herbarium, is described. The species belongs to series *Globuliferae* Benth. of section *Xerocarpa* G. Don. It increases the number of named species recognised in the genus in south-western Australia to 47.

The new species has a high conservation priority as it is known only from one locality on private property in a region with only 7% of native bushland remaining (J. Dewing pers. comm.). Urgent surveys are needed to determine the full extent of the species and what measures need to be taken to ensure its future.

New species description

Scaevola ballajupensis* L.W. Sage, *sp. nov.

Scaevola lanceolato primo aspectu maxime simili sed habitu decumbenti foliis plerumque caulinis et latioribus differt.

Typus: Bridgetown area [precise locality withheld for conservation purposes], Western Australia, 30 September 2000, *L.W. Sage* 2381a, *H.S.R. Sage*, *J.L.J. Sage*, *M.R.W. Sage* & *J.M. Dewing* (*holo:* PERTH 05789338; *iso:* CANB, K, MEL, NSW).

Decumbent perennial herb to c. 15 cm high, spreading to c. 1 m wide, with long, white, simple, soft non-appressed hairs concentrated on the stems and new growth. *Leaves* with scattered hairs, mostly cauline, acute to apiculate, lobed to dentate, narrowly obovate or oblanceolate, 11–75 x 1–17 mm, tapering basally, stem clasping, thin, green. *Inflorescence* a loose, terminal spike; bracts leaf like, 11–43 mm; bracteoles almost immediate below ovary, hairy, 5–11 mm, linear. *Sepals* united into a tube terminated by a rim of teeth c. 0.3 mm long. *Corolla* white with brown markings in the throat, 7.0–11.5 mm, with very short simple, non-appressed hairs outside below and long simple, non-appressed hairs higher up on the lobes outside, bearded inside with long simple hairs and barbulae papillate apically; lobes c. 3 x c. 1 mm, wings c. 0.5 mm wide, entire. *Stamen filaments* linear, flattened, c. 2 mm long. *Anthers* c. 1 mm long. *Ovary* 2-locular, glabrous, c. 1 mm long. *Style* c. 5.0 mm long, with scattered simple hairs; indusium c. 1 mm long, mostly glabrous with some scattered hairs and bristles on both lips. *Fruit* rugose, glabrous, ellipsoid to obovoid, c. 3 mm long. *Seeds* not seen. (Figure 1)

Other specimens examined. WESTERN AUSTRALIA [precise locality withheld]: Bridgetown area, 20 Oct. 1999, J. Dewing, N. Kuser & J. Mead 892; Bridgetown area, 30 Sep. 2000, L. W. Sage 2381b, H.S.R. Sage, J.L.J. Sage, M.R.W. Sage & J.M. Dewing.

Distribution. Known only from one locality on private property near Bridgetown in the Jarrah Forest interim biogeographic region (Thackaway & Cresswell 1995) of Western Australia. (Figure 2)

Habitat. *Eucalyptus marginata*/*Corymbia calophylla* woodland, shrubs to c. 1 m and dwarf shrubs to 0.5 m. Found in brown sandy gravel with some laterite and granite outcropping nearby.

Phenology. Collected in flower in September and October.

Conservation status. Conservation Codes for Western Australia Flora: Priority One. Currently known from only one location on private property that is potentially under the threat of development. This population was estimated by the author to comprise approximately 100 plants. Urgent surveys are required to determine the full extent of this species and to ensure that it is protected or represented on the conservation estate.

Etymology. Named for Ballajup Rock, the local name for a granite outcrop near the only known occurrence of the species.

Notes. This species has been under the informal name *Scaevola* sp. Ballajup Rock (J. Dewing, N. Kuser & J. Mead 892). *Scaevola ballajupensis* belongs to series *Globuliferae* of section *Xerocarpa* and is most closely related to *S. anchusifolia* Benth., *S. lanceolata* Benth. and *S. virgata* Carolin. Characters separating *S. ballajupensis* from these three species are shown in Table 1. It is readily distinguished from *S. lanceolata* and *S. virgata* by its loose inflorescence and from *S. anchusifolia* by its linear bracteoles and its smaller corolla that is white with brown markings in the throat.

Scaevola ballajupensis and *S. virgata* have similar habitat preferences for rocky hills or outcrops (as well as plains for *S. virgata*). *S. lanceolata* occurs mostly on water-gaining areas, road sides or water courses and *S. anchusifolia* occurs mostly in coastal areas on sand dunes or limestone ridges.



Figure 1. Photograph of *Scaevola ballajupensis* taken by Jenny Dewing.

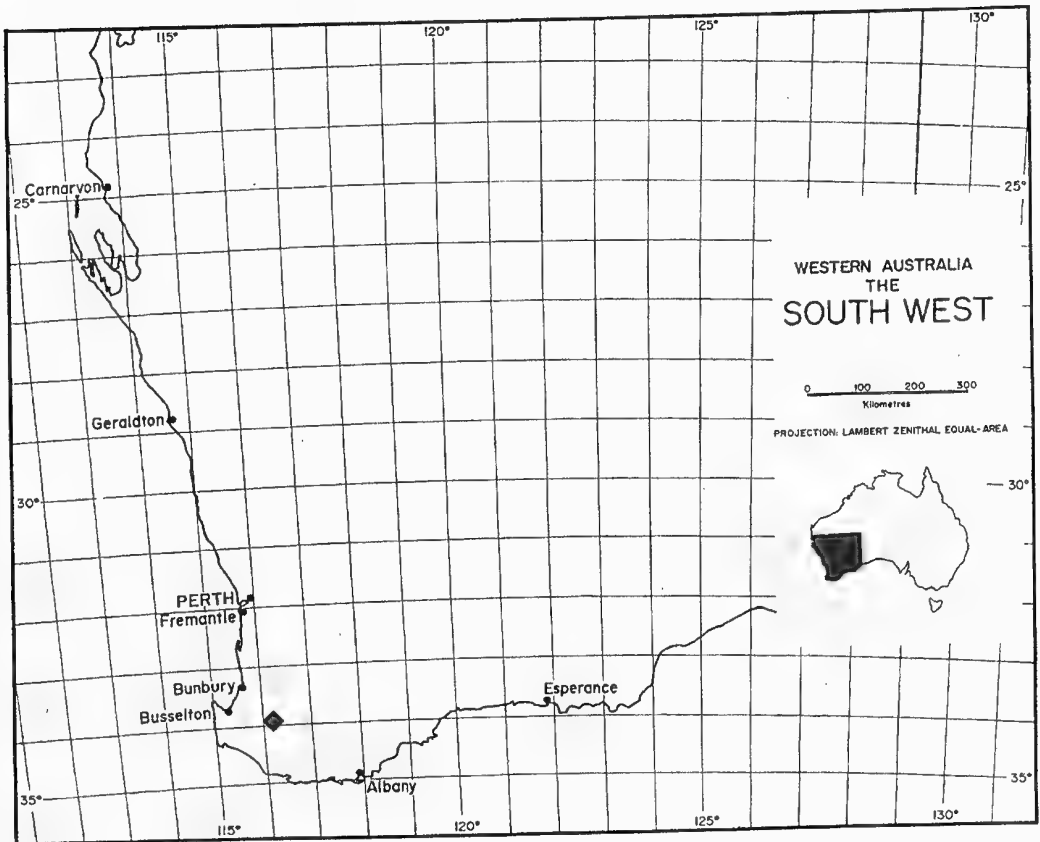


Figure 2. Distribution map of *Scaevola ballajupensis*.

Table 1. Characters distinguishing *Scaevola ballajupensis* from *S. anchusifolia*, *S. lanceolata* and *S. virgata*.

Character	<i>S. ballajupensis</i>	<i>S. lanceolata</i>	<i>S. virgata</i>	<i>S. anchusifolia</i>
habit	decumbent	erect	erect to spreading	decumbent
inflorescence	loose, terminal spikes	terminal, scapose spikes	dense terminal, scapose spikes	loose, terminal spikes
bract apex	acute to acuminate	acute	very acuminate	acuminate
bracteoles	linear	linear-lanceolate	narrowly lanceolate	triangular
sepal lobes	tooth-like, c. 0.3 mm long	tooth-like, to 2 mm long	sinuate, c. 0.3 mm long	well developed, to 1 mm long
corolla length	7–11.5 mm	7–15 mm	5–8 mm	10–22 mm
corolla colour	white with brown markings	white to pale blue with brownish markings	white to pale blue	pale blue

Amendment to the “Flora of Australia” key

The *Scaevola* key in the “Flora of Australia” (Carolin 1992: 86–92) should be altered to read from couplet 11 in Group 4 as follows:

11 Plant prostrate or decumbent

12 Fruit dry (Western Australia)

12a Corolla with golden hairs outside *S. repens*

12a Corolla with white hairs outside *S. ballajupensis*

Acknowledgements

Thanks to Paul Wilson for the Latin diagnosis, Jenny Dewing for her assistance in relocating the species, Heather, Jeremy and Mitchell Sage for assistance in the field and Mike Hislop for bringing the species to my attention.

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A revision of *Hibbertia depressa* and its allies (Dilleniaceae)
from Western Australia

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Abstract

Wheeler, J.R. A revision of *Hibbertia depressa* and its allies (Dilleniaceae) from Western Australia. *Nuytsia* 15(1): 127–138 (2002). A small group of closely related taxa, which form part of section *Candollea* Gilg. in the genus *Hibbertia* Andr., are revised. Descriptions, illustrations and distribution maps are presented along with a key, including two new taxa, *Hibbertia fitzgeraldensis* J.R. Wheeler and *Hibbertia priceana* J.R. Wheeler. Both new species are restricted in distribution and *Hibbertia priceana* appears to be at risk. The lectotypification of *Hibbertia desmophylla* (Benth.) F. Muell. is also made.

Introduction

This is the fifth in a series of papers revising small groups of closely related taxa of the genus *Hibbertia* Andr. (see also Wheeler 2000, 2002a–c). The current paper revises a group of five species, within section *Candollea* Gilg, including two new species. Members in this species group, comprising *Hibbertia depressa* Steud. and its allies, are restricted to the south-west of Western Australia and are characterised by their inconspicuous bracts which remain hidden by the upper leaves. However one of the new species, *H. fitzgeraldensis*, has somewhat more conspicuous bracts than the other species in this group.

Three of the species covered here are currently included on the Department of Conservation and Land Management list of species with conservation priority, including the two new species, both of which are restricted in distribution. The other species are widespread and common and not believed to be under threat, although the response of all five species to attack by *Phytophthora* remains to be documented.

Taxonomy

Key to species in the *Hibbertia depressa* group

- 1. Carpels 5. Stamens 15, in 5 fascicles each of 3 stamens.
(Kent River area to Albany area.) **H. depressa**
- 1. Carpels 3. Stamens 11–13(18), usually in 3 fascicles, if in 5 fascicles then
two of the fascicles reduced to only 2 stamens, sometimes also with 1 or 2 single stamens.

2. Leaves obtuse. Bracts broad, obtuse. Outer sepals acute to obtuse; inner sepals obtuse.
3. Leaves clustered on short shoots, linear, with recurved margins.
4. Anthers narrowly oblong, 1–2 mm long. Sepals all obtuse, the outermost one shorter than the inner ones. (Northern sandplains.) **H. desmophylla**
4. Anthers narrowly obovate, 0.7–0.8 mm long. Sepals obtuse to subacute, subequal. (Stirling Range.) **H. helianthemoides**
3. Leaves alternate, not clustered, flat, oblong-elliptic. (Ongerup area.) **H. priceana**
2. Leaves with a distinct blunt mucro. Bracts narrow, long-acute, often with a leaf-like tip. Outer sepals long-acute; inner sepals acute or obtusely apiculate. (Fitzgerald River National Park.) **H. fitzgeraldensis**

Hibbertia depressa Steud. in Lehm., Pl. Preiss. 1, 268 (1845). *Type citation*: “in clivulo arenoso prope oppidulum Albany, ditionis Plantagenet, 25 Sep. 1840”. *Type*: Albany, Western Australia, 25 September 1840, L. Preiss 2153 (*holo*: LD; *iso*: MEL 666697, MEL 666696).

Candollea fasciculata R. Br. ex DC., Syst. 1, 424 (1817) non *H. fasciculata* R. Br. ex DC. *Type citation*: “in Nova-Hollandia loco King’s Georges sound”. *Type*: King George Sound, Western Australia, 1810, R. Brown (*holo*: G-DC n.v., microfiche seen; *iso*: MEL 666918).

Candollea kochioides Turcz., Bull. Nat. Imp. Nat. Moscou 22(2): 7 (1849). *Type*: Nova Hollandia occidentalis, [Western Australia], 1842, Gilbert 73 (*holo*: KW).

Shrub prostrate or sprawling, to 0.3 m high; branchlets with sparse to dense (in young shoots) long, fine, tangled or somewhat curled hairs, at length somewhat glabrescent, with distant leaf clusters. *Leaves* subsessile, spreading, usually densely clustered on very short shoots, occasionally single and alternate on young growth, linear, 5–25(35) mm long, 1–3(4) mm wide, the margin distinctly recurved, upper surface with long fine hairs dense towards the leaf base giving a shaggy appearance but sparse or glabrescent in the upper half, lower surface with long fine hairs which project at the apex as a distinct apical tuft, apex obtuse or with a very shallow rounded point; bracts to leaf clusters brown, oblong, 5–6 mm long, thin, glabrous. *Flowers* single or clustered among the clustered leaves, 8–11(15) mm diam.; bracts 1–3, brown, ovate to elliptic, 1.5–3 mm long, 1.5–2.5 mm wide, thin, glabrous or rarely with sparse hairs, sometimes ciliate, obtuse to subacute. *Sepals* 5, basally connate, elliptic or ovate-elliptic; outer sepals 3.5–5.5(6) mm long, 1.5–2 mm wide, acute, rarely subacute, with sparse to dense long spreading hairs particularly in the upper half; inner sepals 4–5.5(6) mm long, 2–3 mm wide, obtuse to subacute, slightly broader and glabrous or with very sparse hairs. *Petals* 5, yellow, obovate, 3.5–6(7) mm long, emarginate. *Stamens* 15, in 5 fascicles each of 3 stamens with fused filaments; filament 0.5–1 mm long; anther obovate, 0.5–0.9 mm long. *Carpels* 5, globular, glabrous; ovule 1 per carpel; style 0.7–1.2 mm long. *Fruitlets* obovoid, c. 2 mm long, 1 mm wide; seed brown, ellipsoid, c. 1.5 mm long, with a waxy basal aril. (Figure 1)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Tingle, Point 4277, Gum Link Rd, Walpole district, 12 Dec. 1990, A.R. Annels 1525; Torbay Beach Rd, off Lower Denmark Rd, Torbay, 7 Feb. 1982, E.J. Croxford 1744; Elizabeth St, Lower King, Albany, 25 Oct. 1982, E.J. Croxford 2145; Wood Reserve, sand pit, Nanarup Rd, E of Albany, 25 Oct. 1982, E.J. Croxford 2158; N side of Lake William Rd, near Dunskeys Rd junction, West Cape Howe National Park, 16 Dec. 1990, N. Gibson & M. Lyons 1058; William Bay National Park, track to Lake Williams, 200 m from junction with Madfish Bay Road, 18 Nov. 1990, B.G. Hammersley 484; Denmark Shire, Denbarker forest block, 2+ km W from

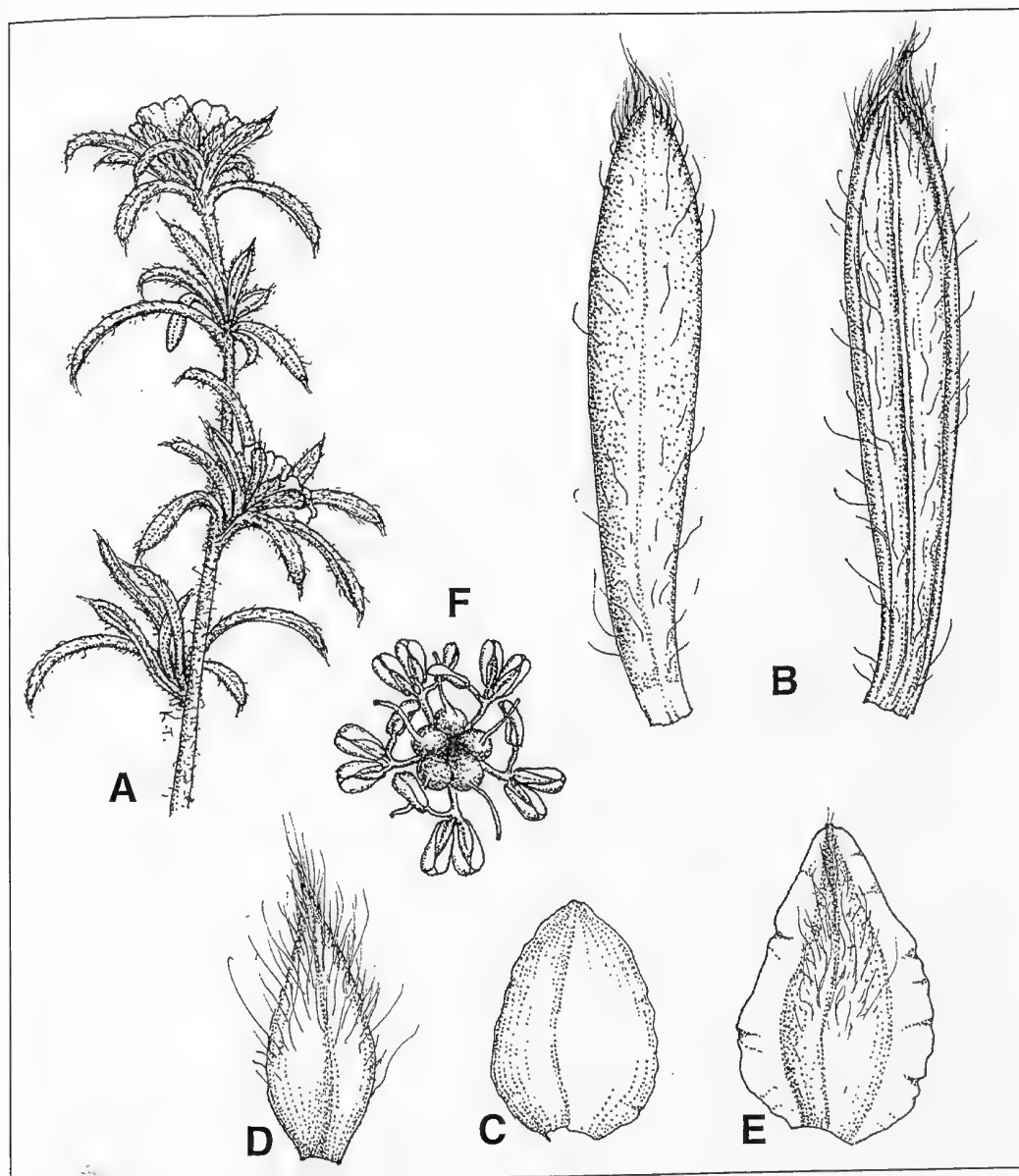


Figure 1. *Hibbertia depressa*. A – flowering branch (x2), B – leaf, upper and lower surface (x8), C – bract (x15), D – outer sepal (x8), E – inner sepal (x8), F – stamens and carpels (x8). Drawn from A.R. Annels 1418 and N. Gibson & M. Lyons 1058.

Denmark–Mount Barker road, along track to WAWA Guaging Station on the Mitchell River, 27 Oct. 1992, B.G. Hammersley 763; Mount Barker, Dec. 1898, R. Helms s.n.; C. Milton's Property, 3 km S of Mount Barker, 355 km S of Perth, 25 Oct. 1977, K.F. Kenneally 6459; E of Albany on road to Mt Taylor, 5 km S of Lower Kalgan to Nanarup Rd, 25 Sep. 1986, J.R. Wheeler 2458 (duplicate AD).

Distribution. Western Australia, South West Botanical Province, IBRA regions (Thackway & Cresswell 1995) of Warren and Jarrah Forest. Recorded from the Kent River area to Nanarup (just east of Albany) and north to Mount Barker with a single collection from as far north as Cranbrook. (Figure 2)

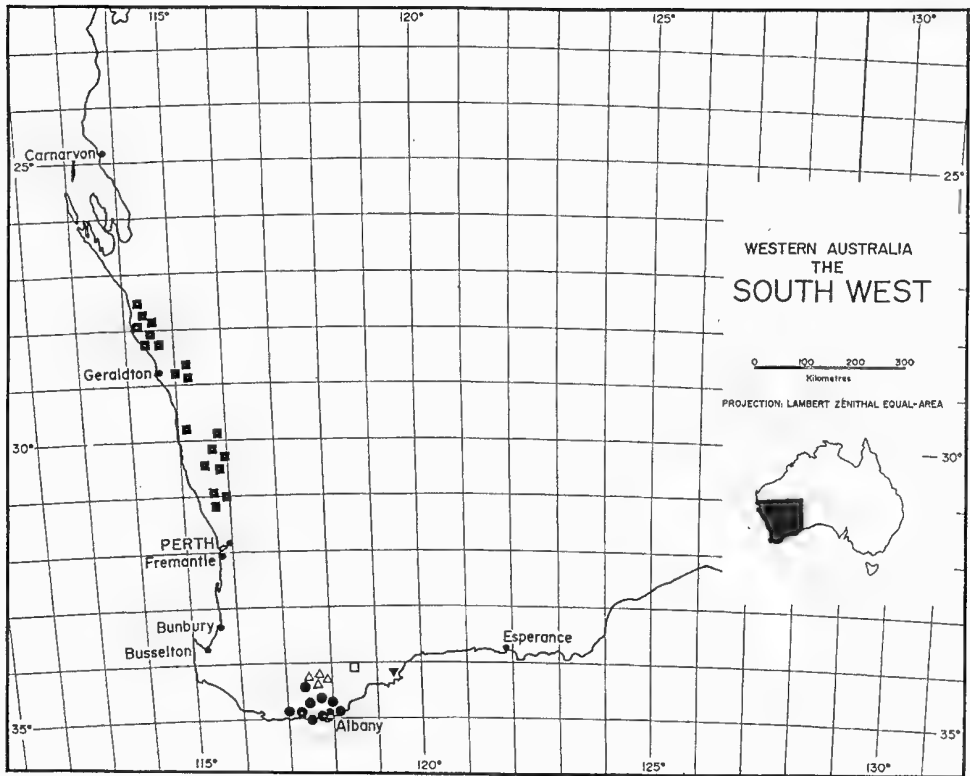


Figure 2. Distribution of *Hibbertia depressa* ●, *H. helianthemoides* △, *H. priceana* □, *H. fitzgeraldensis* ▼ and *H. desmophylla* ■.

Habitat. Commonly occurring in Jarrah woodland or Jarrah-*Banksia* woodland, less often in coastal shrubland on sandy or lateritic soils.

Phenology. Flowers recorded for September to February, with an occasional record for April; fruits recorded November and December.

Affinities. Most closely related to both *Hibbertia helianthemoides* and *H. desmophylla*. *Hibbertia depressa* differs from *H. helianthemoides* in the presence of a more pronounced apical tuft of hairs arising from the undersurface of the leaf apex. The outer sepals of *H. depressa* are more acute with sparse to dense long spreading hairs. *Hibbertia depressa* has always 15 stamens in 5 fascicles (each with 3 anthers) arranged around 5 carpels whereas *H. helianthemoides* has only 3 carpels and 12–13 stamens.

Hibbertia depressa differs from *H. desmophylla* in carpel number and stamen arrangement, leaf tip and in the shape and vestiture of the sepals. *Hibbertia desmophylla* has curlier hairs which never form an apical tuft; sepals which are all very obtuse with the outer ones shorter than the inner; stamens which are variable in number 11–18, but usually in 3 fascicles and often with 1 or 2 additional single stamens; anthers narrowly oblong and longer; carpels 3, with longer styles.

Notes. De Candolle (1817) described *Candollea fasciculata* DC. from a Robert Brown collection from King George Sound and, in the same publication, described an eastern states species *Hibbertia fasciculata* DC. based on a Caley specimen from the Port Jackson area. Bentham (1863) synonymised

C. kochioides Turcz. and *Hibbertia depressa* under *Candollea fasciculata* DC. However, when transferred to the genus *Hibbertia*, the earliest available name for this south-western species became *Hibbertia depressa*, the name *Hibbertia fasciculata* DC. being already in use for the eastern Australian taxon.

Hibbertia desmophylla (Benth.) F. Muell., *Fragm. Phyt. Austral.* 11: 95 (1880). – *Candollea desmophylla* Benth., *Fl. Austral.* 1: 43 (1863) *p.p.* as to the Oldfield syntype. *Type*: Murchison River, [Western Australia], *Oldfield* (*lecto*: MEL 666835, here designated). *Excluded syntype*: "S.W. Australia", *J. Drummond s.n.* (K); Western Australia, ?*J. Drummond* 90 (MEL 666832) [= *Hibbertia fitzgeraldensis*].

Shrub sprawling or erect, to 1 m high, much-branched and sometimes multi-stemmed; branchlets softly hairy with tangled to curled hairs often quite closely appressed to the stem, often with quite close clusters of leaves. *Leaves* subsessile, spreading, densely clustered on short axillary shoots, alternate to spirally arranged on young growth, linear, 6–17(25) mm long and (0.5)1–1.5 mm wide, margin strongly recurved to revolute except sometimes towards the leaf base, hairs tangled to curled and sparse or glabrescent towards the leaf tip but the hairs denser and longer in the lower half particularly towards the margins near the leaf base giving the leaf a somewhat shaggy appearance, apex obtuse. *Flowers* usually single terminating short shoots, less often 2 or 3 clustered together, (7)10–15(20) mm diam.; bracts 1–3, inconspicuous, ovate to elliptic, 1–3 mm long, thin, glabrous or rarely with short sparse hairs, obtuse to subacute. *Sepals* 5, basally connate, elliptic, usually glabrous, sometimes tinged pink to purple towards their tips, obtuse; outer sepals (3)4–5 mm long, 2–2.5 mm wide; inner sepals slightly longer, (4.5)5–6 mm long, 2.5–4 mm wide. *Petals* 5, yellow, obovate, (4)5–10 mm long, emarginate. *Stamens* variable in number, 11–13(18), with 3 fascicles each of (2)3–5 stamens with fused filaments and sometimes 1 or 2 free stamens; filaments 1–1.5 mm long; anther narrowly oblong, (1)1.3–2 mm long. *Carpels* 3, globular, glabrous; ovule 1 per carpel; style 1.5–2.5 mm long. *Fruitlets* obovoid, 2–2.5 mm long, 1.5–2 mm wide; seed brown, globular to very broadly ellipsoid, 1.5–1.8 mm long, with a waxy basal aril. (Figure 3)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: 1.2 km E along old vermin fence from Kalbarri, Balline Rd, 7 Sep. 1999, *D. & B. Bellairs* 6030; Eradu, E of Geraldton, 24 Oct. 1965, *A.C. Burns* 7; Chapman's farm Coorow, 16 July 1980, *R.J. Cranfield* 1483; Binu West Rd, 3.4 km c. E of intersection with Ogilvie West Rd (52 km due NW of Northampton), 27 Sep. 1985, *J. D'Alonzo* 626; Red Gully Road, 3.4 km E of junction with Brand Highway near Moore River National Park, 1 Oct. 1988, *J.M. Fox* 88/063 (duplicate CANB *n.v.*); Hill River, no date, *C.A. Gardner* 12783; Lake Indoon (W of Eneabba) N of Leeman Rd, opposite track to lake, 9 Nov. 1981, *E.A. Griffin* 3213; c. 8 miles [13 km] S of turnoff from Geraldton–Mullewa road to The Casuarinas (c. 36 miles [58 km] E of Geraldton), 18 Sep. 1971, *R.D. Hoogland* 11981 (duplicates CANB, HBG, L, UC all *n.v.*); Moore River National Park, 2 Oct. 1971, *R.D. Royce* 9478; Watheroo National Park, W of Watheroo (S boundary of park) 4 Oct. 1971, *R.D. Royce* 9554.

Distribution. Western Australia, South West Botanical Province, IBRA regions (Thackway & Cresswell 1995) of Geraldton Sandplains and Swan Coastal Plain, occurring from the Murchison River south to Moore River National Park. (Figure 2)

Habitat. Occurs on sand in heath, shrubland and low open banksia woodland.

Phenology. Flowers recorded June to December; fruits recorded September to December and February.

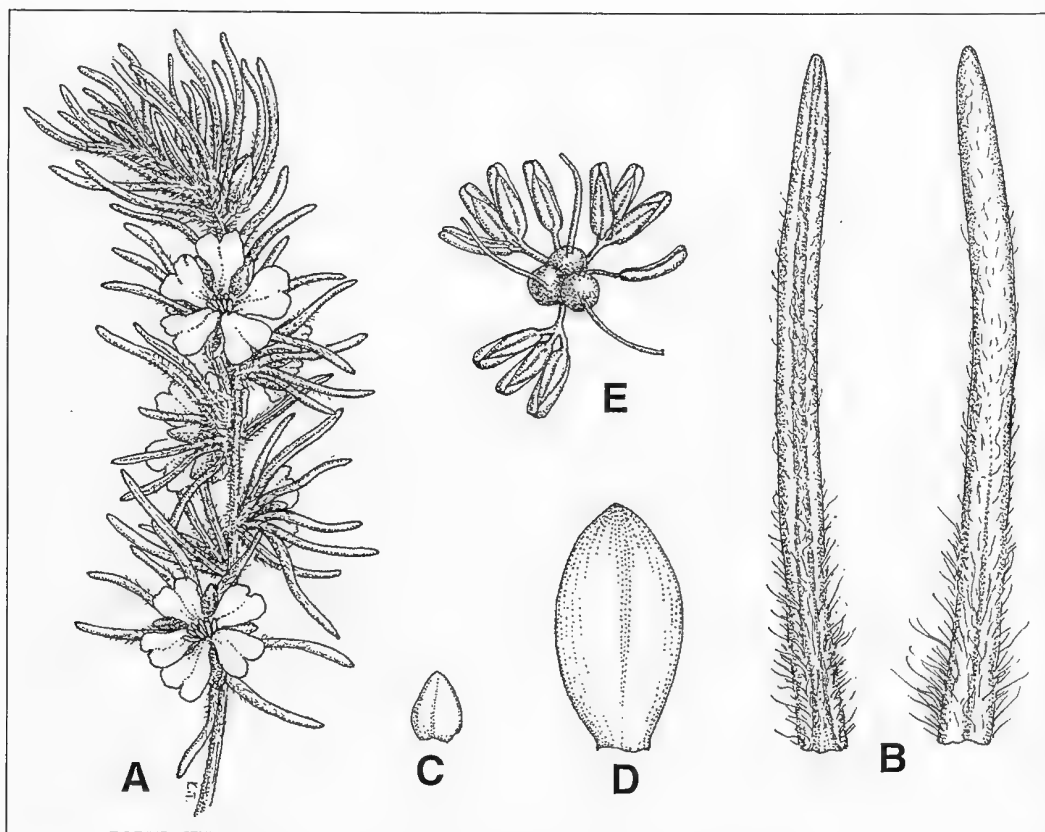


Figure 3. *Hibbertia desmophylla*. A – flowering branch (x2), B – leaf, upper and lower surface (x8), C – bract (x8), D – sepal (x8), E – stamens and carpels (x8). Drawn from R.J. Cranfield 1483 and E.A. Griffin 928.

Lectotypification. There are two syntypes of *Candollea desmophylla* Benth., clearly of two different taxa. The Oldfield syntype is chosen as the lectotype for *Hibbertia desmophylla* because it fits the description in the protologue of the stamens being in “3 bundles of 3 or 4 each” (over a larger number of specimens a variation of 3–5 per bundle has been observed with occasionally also 1 or 2 single stamens) and belongs to the much more common and widely distributed of the two taxa. This species from the northern sandplains of Western Australia is the one to which the name *H. desmophylla* has generally been applied.

The excluded syntype, collected by J. Drummond, belongs to *Hibbertia fitzgeraldensis*, a species from Fitzgerald River National Park on the south coast of the Western Australia, which has 11(12) stamens all around the carpels, 9 of them with their filaments fused into 3 fascicles each of 3 stamens, the remaining 2 stamens free or 2 fused and 1 free. The Kew specimen of this syntype has no number either on the label or the specimen and has the label information of “S.W. Australia, Drummond, 1849”. An apparently matching specimen examined from MEL has had a number (90) attached to it, and the label information is “W.A. J. Drummond”. It is thought to be of the same gathering as the K specimen.

Affinities. *Hibbertia desmophylla* differs from both *H. helianthemoides* and *H. depressa* in the more curly nature of its indumentum, its glabrous very obtuse sepals with the outermost slightly but distinctly

shorter than the inner sepals. *Hibbertia desmophylla* has a variable number of stamens with the anthers differing in size and shape, being narrower and longer than those of *H. depressa* or *H. helianthemoides*. The styles of *H. desmophylla* are also longer. *Hibbertia desmophylla* also differs from *H. depressa* in the lack of apical hair tuft and its reduced carpel number.

Notes. There is considerable variation in the density of indumentum within this species. The sepals are almost always glabrous, although a few collections from between Watheroo and Moore River have short appressed hairs.

Hibbertia fitzgeraldensis J.R. Wheeler, *sp. nov.*

[*Candollea desmophylla* auct. non Benth.: Benth., Fl. Austral. 1: 43 (1863) *p.p.* as to excluded syntype *J. Drummond*, not as to lectotype.]

Hibbertiae depressae, H. helianthemoidi et H. desmophyllae affinis sed foliis obtuso mucronatis, bracteis anguste triangularibus et sepalis longe acutis differt.

Typus: Fitzgerald River National Park, summit of West Mt Barren, Western Australia, 23 September 1986, J.R. Wheeler 2435 (*holo:* PERTH 03034860; *iso:* AD, CANB, K, MEL).

Shrub sprawling, to 0.3 m high; branchlets softly hairy with fine hairs. *Leaves* alternate or clustered on alternate short shoots, linear with slightly to strongly recurved margins, (5)7–30(55) mm long, 0.5–3(6) mm wide, upper surface with fine soft hairs but glabrescent in upper half, lower surface with long fine soft hairs, the leaf base fairly shaggy, apex a distinct and hard but fairly blunt mucro. *Flowers* terminating short axillary shoots, 9–12 mm diam., sessile; bracts 1–3, very narrowly triangular, 3.5–5.5 mm long, c. 1 mm wide, ciliate and softly hairy, apex long-acute or with a leaf-like tip. *Sepals* 5, basally connate, narrowly elliptic, usually glabrous apart from a few brownish apical hairs or marginal cilia, occasionally the outermost with sparse appressed white hairs in the upper half; outer sepals 5.5–7 mm long, 1.5–2 mm wide, long-acute; inner sepals broader and less tapered towards the acuminate or awn-like tip, slightly shorter, 5–6 mm long, 2–2.5 mm wide. *Petals* 5, yellow, obovate, 4.5–7 mm long, very shallowly emarginate. *Stamens* 11(12) all around the carpels, 9 of them with their filaments fused into 3 fascicles each of 3 stamens, the remaining 2 stamens free or 2 fused and 1 free; filament c. 1 mm long; anther narrowly oblong-elliptic, 1–1.4 mm long. *Carpels* 3; ovule 1 per carpel; style 1.2–2 mm long. *Fruitlets* obovoid, 2.5–3 mm long, c. 2 mm wide; seeds brown, ellipsoid, c. 2 mm long, with a waxy basal aril. (Figure 4A–F)

Selected specimens examined (all PERTH except where indicated). WESTERN AUSTRALIA: SW Australia, *J. Drummond* (K, ?MEL); West Mt Barren, 16 Oct. 1928, *C.A. Gardner* 2218; summit of West Mt Barren, 28 Oct. 1965, *A.S. George* 6975; Mt Bland, 6 Apr. 1963, *K.R. Newbey* 735; at foot of Mt Bland, Fitzgerald River National Park, 20 Oct. 1970, *R.D. Royce* 9114; halfway up E slope of West Mt Barren, Fitzgerald River National Park, 23 Sep. 1986, *J.R. Wheeler* 2438 (duplicates AD, CANB, K); Fitzgerald River National Park, track to Mt Maxwell, 0.6 km N of Collets Rd, 6 Sep. 2001, *J.R. Wheeler* 4075 (duplicates AD, MEL); Fitzgerald River National Park, Mt Maxwell, near car park, 6 Sep. 2001, *J.R. Wheeler* 4076 (duplicates AD, CANB, K); Fitzgerald River National Park, E slopes of West Mt Barren, 6 Sep. 2001, *J.R. Wheeler* 4081 (duplicate K); Fitzgerald River National Park, Point Ann Rd, 4.2 km N of Trigelow Beach Rd junction (100 m N of road) and 8.6 km SE from Collets Rd, 7 Sep. 2001, *J.R. Wheeler* 4091 (duplicates¹AD, NSW).

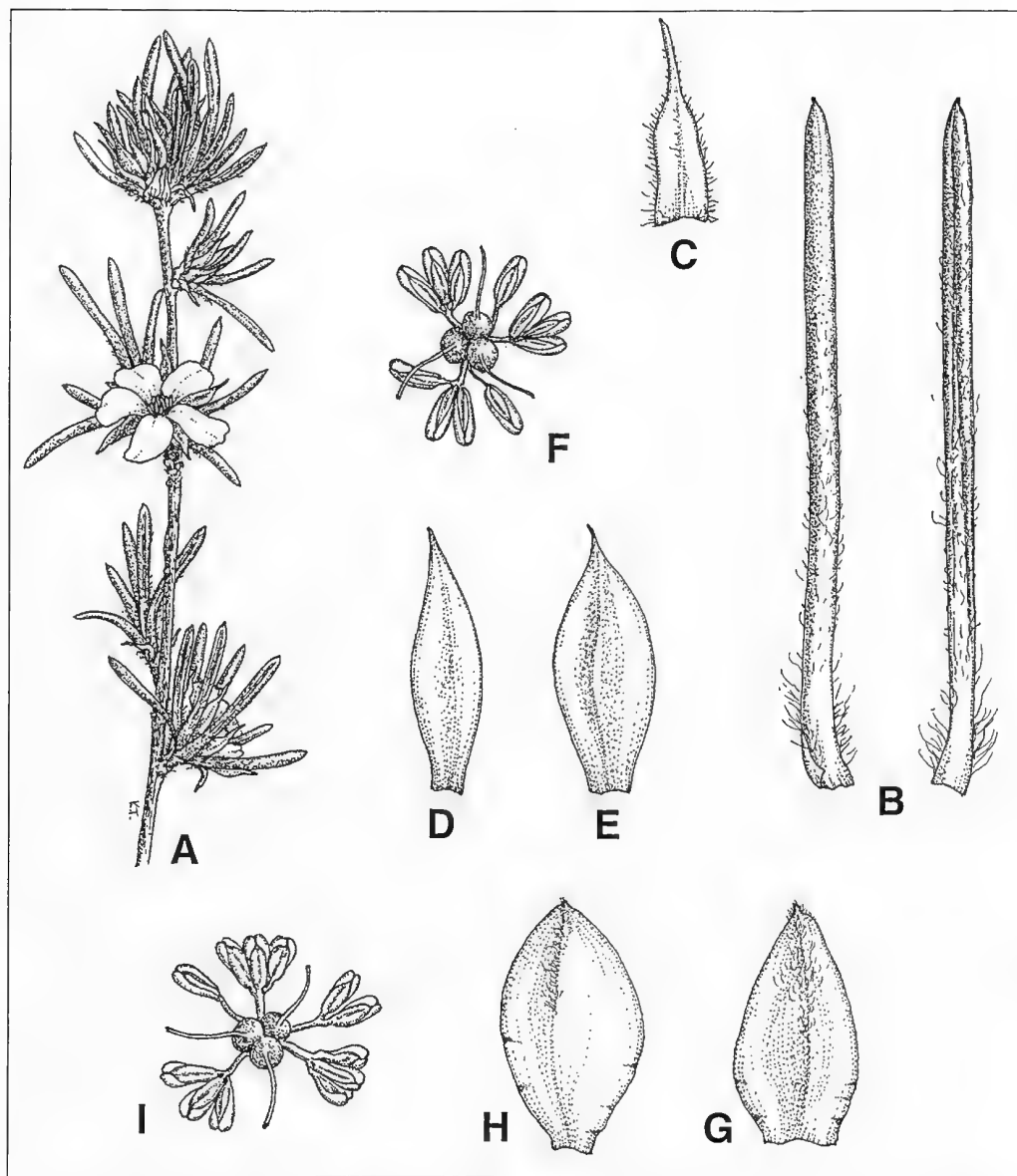


Figure 4. A–F. *Hibbertia fitzgeraldensis*, drawn from R.D. Royce 9114 and J.R. Wheeler 2438. A – flowering branch (x2), B – leaf, upper and lower surface (x8), C – bract (x8), D – outer sepal (x8), E – inner sepal (x8), F – stamens and carpels (x8); G–I. *Hibbertia helianthemoides*, drawn from J.R. Wheeler 2497. G – outer sepal (x8), H – inner sepals (x8), I – stamens and carpels (x8).

Distribution. Western Australia, South West Botanical Province, IBRA region (Thackway & Cresswell 1995) of Esperance Plains. Apparently restricted to mountains of the south-west of Fitzgerald River National Park. (Figure 2)

Habitat. Recorded in heath from sand or black loam over granite, often from rocky slopes or the summits of hills.

Phenology. Flowers September to October, also recorded for April; fruits recorded for October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Apparently restricted in distribution, but occurring in a national park and not currently threatened.

Etymology. The name refers to the area, the Fitzgerald River National Park, in which the species occurs.

Affinities. Differs from other species of this group in the blunt but distinct mucro to its leaves. *Hibbertia fitzgeraldensis* also differs in its more conspicuous and narrowly triangular, acute to awned hairy bracts and in its sepals which are slightly larger and long-acute or awned.

Hibbertia fitzgeraldensis also shows similarities to the *Hibbertia ferruginea* group having similar sepals which are gradually tapered and long-acute, the outer sepals being slightly longer than the inner sepals (Wheeler 2003 in prep.). However it clearly differs from the *H. ferruginea* group in the shape of its bracts and in its more clustered leaves. *Hibbertia fitzgeraldensis* perhaps forms a link between the two groups within section *Candollea*.

Notes. A collection from near Mt Maxwell (J.R. Wheeler 4075) has particularly luxuriant foliage with leaves up to 55 mm long and 6 mm wide and which have only slightly recurved margins.

Hibbertia helianthemoides (Turcz.) F. Muell., Syst. Census Austral. Pl. 2 (1883). – *Candollea helianthemoides* Turcz., Bull. Soc. Imp. Naturalistes Moscou 22(2): 8 (1849). Type: Nova Hollandia [Western Australia], J. Drummond coll. 4, n. 118 (holo: KW; iso: PERTH).

Shrub prostrate or low, spreading to erect, usually to 0.3 m, rarely to 1 m high; branchlets softly hairy with tangled or curled hairs, with distant leaf clusters. **Leaves** subsessile, spreading, densely clustered on short axillary shoots, linear, 5–15(20) mm long, 0.7–2(3) mm wide, margin recurved to revolute, softly hairy with fine hairs which are dense and spreading to give the leaf base a shaggy appearance, hairs more appressed and sparser or sometimes glabrescent towards the leaf tip, rarely forming an indistinct apical tuft, apex obtuse. **Flowers** single or few amongst the leaves terminating short shoots, sessile, 9–13 mm diam.; bracts 1–3, hidden amongst the floral leaves, ovate to elliptic, 0.5–3 mm long, thin, glabrous or with sparse appressed hairs, obtuse. **Sepals** 5, basally connate, elliptic, subequal, 3–5.5 mm long, 1.5–3 mm wide; outer sepals subacute to almost obtuse, glabrous or with short appressed hairs towards the apex and down the centre of the sepal; inner sepals obtuse, often glabrous. **Petals** 5, yellow, obovate, 5–8 mm long, emarginate. **Stamens** usually 13, arranged in 3 fascicles each of 3 stamens with fused filaments and 2 fascicles each of 2 stamens with fused filaments, rarely one of the fascicles reduced to a single stamen; filament 0.5–1 mm long; anther obovate to oblong-obovate, 0.5–1 mm long. **Carpels** 3, glabrous; ovule 1 per carpel; style 1–1.2 mm long. **Fruitlets** obovoid, c. 2 mm long, 1.2 mm wide; seeds brown, ellipsoid, c. 2 mm long, with a waxy basal aril. (Figure 4G–I)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Plot 5178, Reserve 16262, SW of Tenterden, 20 July 1993, A.R. Annels 3432; Hume Peak, Stirling Range, 1 Oct. 1995, S. Barrett 458; Stirling Range, 0.6 km from Red Gum Springs towards Cranbrook, 10 Oct. 1968, E.M. Canning WA/686192 (duplicate CANB n.v.); near Red Gum Springs, 9 Oct. 1962, A.R. Fairall 480; N side of Stirling Range Drive, c. 5.7 km E of junction with Red Gum Pass, Stirling Range National Park, 9 Oct. 1999, J.W. Horn 2819 (duplicate DUKE n.v.); between Solomons Well and Conical Hill, 27 Sep. 1902, A. Morrison s.n.; near Stirling Range Drive, c. 38 km from junction with Chester Pass Rd and c. 4 km from junction with Red Gum Pass Rd, between Mt Mondurup and Baby Barnett Hill, 30 Sep. 1986,

J.R. Wheeler 2496; near Stirling Range Drive, c. 38 km from junction with Chester Pass Rd and c. 4 km from junction with Red Gum Pass Rd, between Mt Mondurup and Baby Barnett Hill, 30 Sep. 1986, *J.R. Wheeler* 2497.

Distribution. Western Australia, South West Botanical Province, IBRA regions (Thackway & Cresswell 1995) of Jarrah Forest and Esperance Plains. Apparently restricted to the western Stirling Ranges and west towards Tenterden. (Figure 2)

Habitat. Occurs in woodland or shrubland on clayey sand over sandstone, loam over quartzite or on scree slopes.

Phenology. Flowers recorded for September to October, with a single record for July; fruits recorded for October.

Conservation status. Conservation Codes for Western Australian Flora: Priority Three. Apparently restricted in distribution but occurring in a national park.

Affinities. Most closely related to *H. depressa* and *H. desmophylla*, to which it is vegetatively very similar, although the apical tuft of hairs of the leaves of *H. helianthemoides* is absent or less prominent. The outer sepals of *H. helianthemoides* are less acute (usually subacute to almost obtuse) than those of *H. depressa* and are either glabrous or with minute very appressed hairs which are concentrated at the apex or down the midline of the outer sepal. *Hibbertia helianthemoides* has fewer stamens than *H. depressa*, usually 13 with 3 fascicles each with 3 anthers and commonly 2 fascicles each with only 2 anthers one of which is sometimes reduced to a single stamen. The anthers of both species are similar in shape and the carpels and styles similar.

Hibbertia desmophylla differs from *H. helianthemoides* in its more variable stamen number (often with up to 5 stamens per fascicle) and anther shape and size. The sepals of both species are often glabrous, but those of *H. desmophylla* are all more obtuse and the outer sepals distinctly shorter.

Hibbertia priceana J.R. Wheeler, *sp. nov.*

Hibbertiae depressae affinis sed foliis applanatis oblongo-ellipticis, antheris ellipticis longioribus, sepalis semper glabris et obtusioribus, carpellis et staminibus paucioribus, a *H. helianthemoidi* foliis applanatis oblongo-ellipticis, antheris ellipticis longioribus differt.

Typus: Ongerup area [precise locality withheld], Western Australia, 31 July 2001, *J.R. Wheeler* 4063 (*holo:* PERTH; *iso:* AD, CANB, K).

Shrub to 0.15 m high, dwarf and usually compact but sometimes sprawling, with bluish grey tinged foliage; branchlets hairy with tangled to curly hairs. *Leaves* sessile, alternate, ascending, narrowly oblong-elliptic, 4.5–10.5 mm long, 1.5–3 mm wide, flat, moderately hairy with fine long and somewhat tangled or curled hairs, margin and midrib thickened, apex obtuse. *Flowers* sessile, terminating very short axillary shoots, 12–15(17) mm diam.; bracts 1–3, ovate, 1–2.5 mm long, glabrous or with a very few hairs towards the tip and obtuse or the outermost with a short hairy leaf-like tip. *Sepals* 5, reddish brown, basally connate, broadly elliptic, subequal, 4–6 mm long, 2.5–3 mm wide, glabrous; outer sepals subacute to obtuse; inner sepals obtuse to very shallowly emarginate. *Petals* 5, bright yellow, obovate,

6–9 mm long, emarginate. *Stamens* 11, 9 of them in 3 fascicles each of 3 stamens with fused filaments and the remaining 2 stamens free; filament 1–1.5 mm long; anther elliptic, 1.5–1.8 mm long, the apex of each cell sometimes split and diverging after dehiscence so as to appear 2-lobed. *Carpels* 3, obovoid-globular, glabrous; style 1–2 mm long, spreading; ovule 1 per carpel. *Fruitlets* narrowly ellipsoid, c. 3 mm long, 1 mm wide; seed narrowly oblong-ellipsoid, 2.2 mm long, with a large waxy aril. (Figure 5)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: Ongerup area, 29 June 1970, K.R. Newbey 3190; Ongerup area, June 1987, J. Price s.n.; Ongerup area, 18 July 1987, J.R. Wheeler 2520 (duplicates AD, MEL); Ongerup area, 3 Oct 1986, J.R. Wheeler 2511; Ongerup area, 31 July 2001, J.R. Wheeler 4063A; Ongerup area, 15 Aug. 2001, J.R. Wheeler 4064.

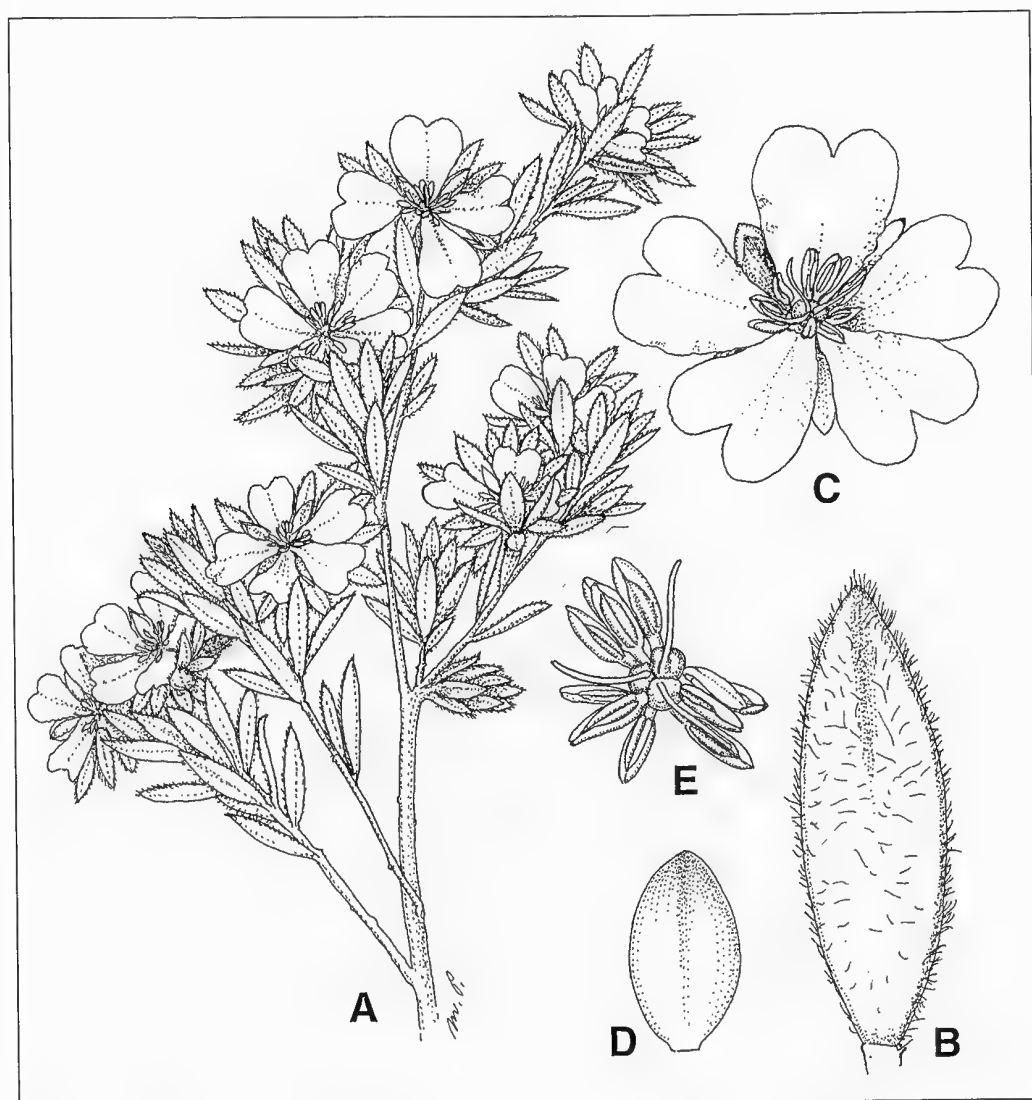


Figure 5. *Hibbertia priceana*. A – flowering branch (x2), B – leaf (x8), C – flower (x4), D – sepal (x8), E – stamens and carpels (x8). Drawn from J.R. Wheeler 2520.

Distribution. Western Australia, South West Botanical Province, IBRA region (Thackway & Cresswell 1995) of Mallee. Appears to be restricted to the Ongerup area. (Figure 2)

Habitat. Grey sandy clay with lateritic gravel on ridges in mallee-heath vegetation with *Eucalyptus redunca* and *Dryandra cirsioides*.

Phenology. Flowers recorded June to August; fruits recorded for October.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Known only from a very few populations on road verges.

Etymology. Named in honour of John Price of the Ongerup area who first drew my attention to the taxon.

Affinities. Most closely related to both *Hibbertia depressa* and *H. helianthemoides* but differing in its more compact habit, its bluish grey-tinged leaves which are flat, narrowly oblong-elliptic and not clustered. *Hibbertia priceana* also differs from both *H. depressa* and *H. helianthemoides* in its longer elliptic anthers and from *H. depressa* in its reduced number of carpels and stamens.

Acknowledgements

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Miscellaneous new species of *Hibbertia* (Dilleniaceae) from the wheatbelt and pastoral areas of Western Australia

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Abstract

Wheeler, J.R. Miscellaneous new species of *Hibbertia* (Dilleniaceae) from the wheatbelt and pastoral areas of Western Australia. *Nuytsia* 15(2): 139–152 (2002). The new taxa, *Hibbertia ancistrophylla* J.R. Wheeler, *H. ancistrotricha* J.R. Wheeler, *H. avonensis* J.R. Wheeler, *H. lepidocalyx* J.R. Wheeler, *H. lepidocalyx* subsp. *tuberculata* J.R. Wheeler and *H. stenophylla* J.R. Wheeler are described, mapped and illustrated. All belong to either section *Pleurandra* (Labill.) Benth. or section *Hemipleurandra* Benth. They are recorded from the Avon Wheatbelt, Jarrah Forest and Mallee regions of the South West Botanical Province and the Coolgardie, Murchison and Yalgoo regions of the Eremaean Province.

Introduction

During research on the genus *Hibbertia* Andr., a number of new taxa have come to light. This paper, which is one of a series on the genus *Hibbertia* (Wheeler 2000, 2002a–d), validates new names from the wheatbelt and pastoral areas of Western Australia. The taxa all belong to either section *Pleurandra* (Labill.) Benth. or section *Hemipleurandra* Benth. (Benth. 1863). Terminology of indumentum and leaf shape follows that used in earlier papers (Wheeler 2000). Only one of the new taxa is currently considered to have conservation priority, but the response of each taxon to *Phytophthora* attack has not been documented.

Taxonomy

Hibbertia ancistrophylla* J.R. Wheeler, *sp. nov.

Species propria foliis uncinatis pungentibus, floribus subsessilibus, sepalis et bracteis glabriusculis mucronatis, staminibus 8–11 unilateralibus, staminodiis absentibus, carpellis 2 pilosis 4-ovulatis.

Typus: 21 km west of Mollerin on Burakin–Wialki road, Western Australia, 20 July 1989, J.R. Wheeler 2634 (*holo*: PERTH 06130518; *iso*: AD, CANB, K, MEL).

Shrub to 0.6 m high; branchlets glabrous. *Leaves* alternate to spirally arranged, sessile, linear, 2–8 mm long, 0.7–1 (1.5) mm wide, thick with the margins closely revolute to the enlarged midrib, glabrous or with sparse uncinata hairs particularly towards the margins, sometimes with minute appressed hairs towards the base of the upper surface, smooth or with occasional tubercles, apparent margins thick and rounded to somewhat compressed, apex recurved with a pale pungent curved mucro. *Flowers* terminating short shoots, 7–12 mm diam., sessile or subsessile with very short peduncles to 3 mm long. *Bracts* 1–5 below each flower, narrowly ovate to ovate or elliptic, 1–2.5 mm long, glabrous, often ciliolate, mucronate. *Sepals* 5, elliptic, subequal or the innermost slightly longer, 3.5–5.5 mm long, outer surface glabrous or with minute v-shaped semi-stellate hairs particularly on the inner sepals, inner surface glabrous or with small appressed hairs particularly in the upper half, often minutely ciliolate; outer sepals 2–3 mm wide, apically keeled to a short pungent mucro; inner sepals broader, 2.5–3.5 mm wide, obtuse but sometimes minutely mucronate. *Petals* 5, deep yellow, obovate, 5–8 mm long, emarginate. *Stamens* 8–11, basally fused, all on one side of the carpels; filament 0.5–1 mm long; anther narrowly oblong, c. 1.5 mm long; staminodes absent. *Carpels* 2, more or less globular to obovoid, with white simple hairs; style erect, c. 1.5 mm long, glabrous; ovules (2)4 per carpel. *Fruitlets* not seen mature. (Figure 1)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: vicinity of Perkolilli Waterhole, 30°42'S, 121°39'E, 18 June 1975, *J.S. Beard* 7407; between Caron and Latham, between Wongan Hills and Morowa, 24 Sep. 1931, *W.E. Blackall* 762; 8 km E of Walgoolan between Merredin and Southern Cross, 22 Aug. 1939, *W.E. Blackall* 4015; Nature Reserve no. 28715, 20 km N of Hyden, 6 Sep. 1984, *J.M. Brown* 150 (duplicate AD *n.v.*); 16.7 km from Moorine Rock towards Perth along Great Eastern Highway, 10 Sep. 1968, *E.M. Canning* WA/68 2676 (duplicate CBG *n.v.*); 1 km E of big breakaway on Williamson Rd, Flint's Farm, 50 km NE of Hyden, 9 July 2000, *J.M. Flint* 169; 9.4 km W of Stewart on Westrail line towards Koolyanobbing, Coolgardie District, 29 Aug. 1997, *G. Flowers & S. Donaldson* GF110 (duplicate CBG *n.v.*); c. 6 miles [9.3 km] SE of Kulja along road to Koorda, 29 Sep. 1971, *R.D. Hoogland* 12042 (duplicates CANB, HBG, K, L, MEL, UC, US all *n.v.*); Bonnie Rock–Burakin road, 3 km E of junction with Koorda–Kulja road, 17 Sep. 1999, *J.W. Horn* 2502 (duplicate DUKE *n.v.*); both sides of Kondinin–Narembeen road, 4.5 km S of its junction with Bendering East Rd, 22 Sep. 2001, *J.W. Horn* 4101 (duplicate DUKE, *n.v.*).

Distribution. Western Australia, South West and Eremaean Botanical Provinces, IBRA regions Avon Wheatbelt, Mallee and Coolgardie. Recorded from between Wubin and Paynes Find south to near Hyden and east to Coolgardie. (Figure 2A)

Habitat. Occurs in shrubland or heath, recorded mostly from sand, but occasionally from clay or lateritic soil.

Phenology. Flowers June to October; mature fruits not seen.

Conservation status. Widespread and quite common, not believed to be under threat.

Etymology. From the Greek *ancistrōn* – fish-hook and *phyllon* – leaf, referring to the strongly hooked leaf apex.

Affinities. The position of the stamens all on one side of the carpels and the absence of staminodes indicates that *Hibbertia ancistrophylla* belongs to the section *Pleurandra*. *Hibbertia ancistrophylla* resembles *H. eatoniae* Diels in its strongly hooked small leaves and in its hairy and usually 4-ovulate

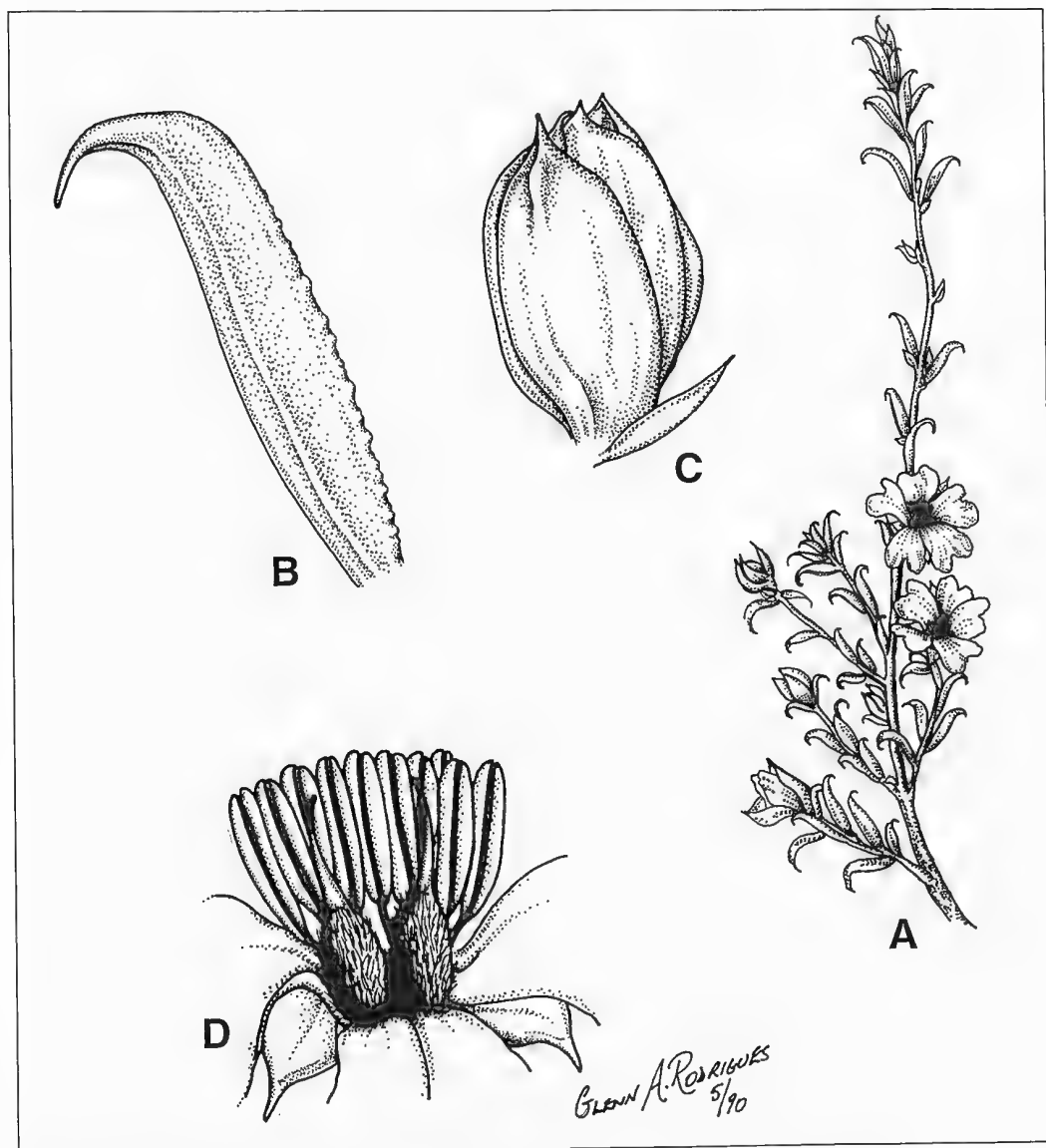


Figure 1. *Hibbertia ancistrophylla*. A – flowering branch (x2), B – leaf (x8), C – bud showing sepals and bract (x10), D – stamens and carpels (x10). Drawn by Glenn Rodrigues.

carpels, but differs in its sessile or subsessile flowers, and almost glabrous bracts and sepals. *Hibbertia eatoniae* has leaves with short scale-covered petioles, prominently pedunculate flowers, scale-covered to stellate-hairy bracts and sepals which are not or scarcely mucronate and carpels covered with stellate hairs.

Notes. Previously known by the phrase name *Hibbertia* sp. *Kulja* (J.R. Wheeler 2581). A specimen from between Wubin and Paynes Find has obtuse outer sepals which lack the mucronate apex. Two collections (J.M. Brown 150, J.M. Flint 169) from near Hyden have 2 rather than 4 ovules per carpel.

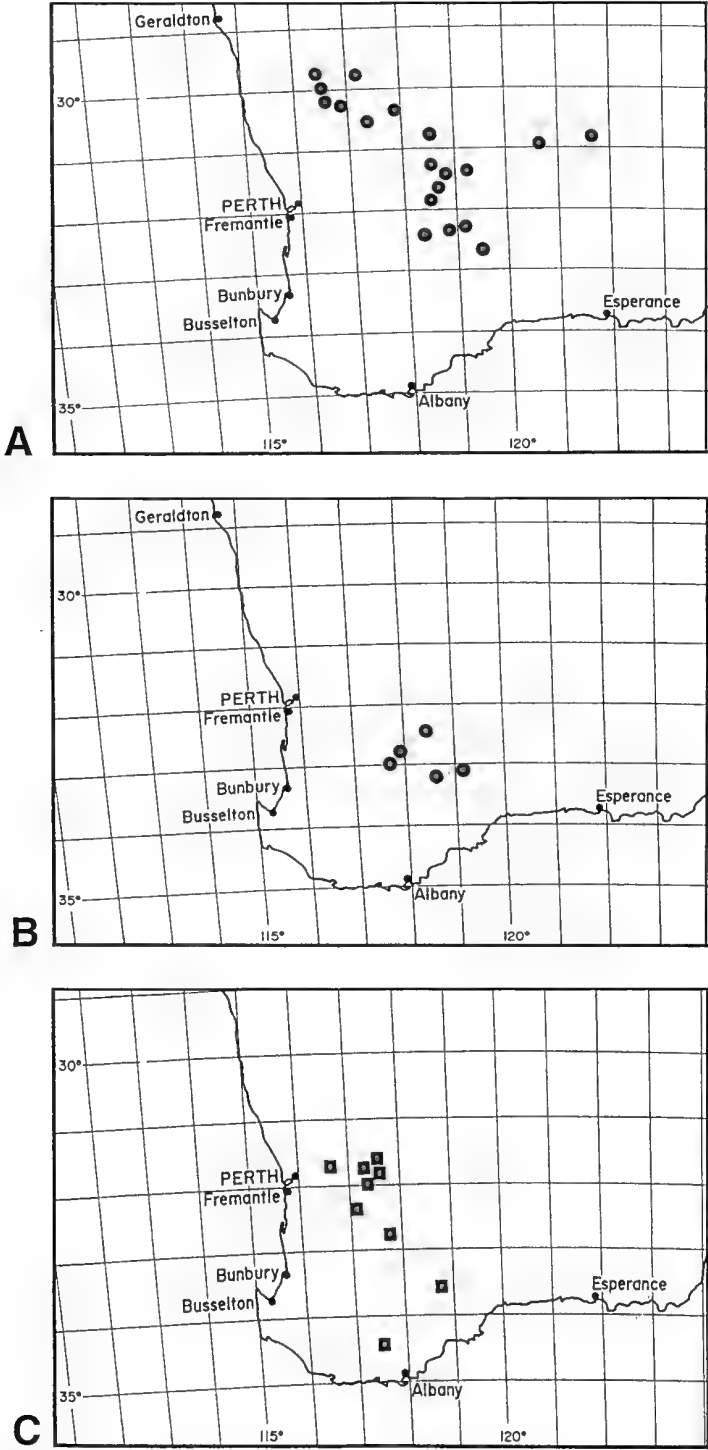


Figure 2. Distribution maps. A – *Hibbertia ancistrophylla*; B – *Hibbertia ancistrotricha*; C – *H. avonensis*.

Hibbertia ancistrotricha* J.R. Wheeler, *sp. nov.

Species foliis crassis rigidis breviter pungentibus, floribus breviter pedunculatis, bractea anguste triangulari, sepalis pilis uncinatis, staminibus 10(12) unilateralibus, staminodiis absentibus, carpellis 2 pilosis 4-ovulatis.

Typus: east of Dudinin, gravel pit 1.5 km east of Dudinin on the Dudinin–Kulin road, Western Australia, 11 October 2001, J.R. Wheeler 4149 (*holo*: PERTH 06130526; *iso*: AD, CANB, K, MEL, NSW).

Shrub to 1.3 m high; branchlets glabrous or with minute simple or v-shaped semi-stellate hairs and glabrescent. *Leaves* spirally arranged, spreading, subsessile to very shortly petiolate; petiole up to 0.5 mm long, with minute dense simple or semi-stellate hairs; blade narrowly oblong to linear, 2.5–8 mm long, 0.8–1.2(1.5) mm wide, thick with the margins tightly recurved to a more or less level or slightly sunken midrib, glabrescent, the young leaves with very occasional uncinata hairs, upper surface very minutely reticulate to papillose, apparent margin rounded, apex obtuse but the midrib extended as a fairly thick and rigid very short mucro up to 0.2 mm long. *Flowers* solitary and axillary, 8–15 mm diam., shortly pedunculate; peduncle 2–8 mm long, with sparse semi-stellate to stellate hairs. *Bracts* several at base of peduncle and 1 immediately below the flower; uppermost bract broader than lower bracts, very narrowly triangular, 1.5–2.5 mm long, herbaceous, the margin and upper surface with sparse simple and uncinata hairs, acute. *Sepals* 5, basally fused, dark green tinged red, elliptic, subequal or the innermost slightly longer, 4–5 mm long; outer sepals 1.8–2.5 mm wide, with a prominent midrib, hairy with uncinata hairs, long-acute, ciliate; inner sepals c. 3 mm wide, with a less prominent midrib, hairy with uncinata hairs and also some minute stellate or semi-stellate hairs towards the broad almost glabrous margins, shortly acuminate, ciliate. *Petals* 5, bright yellow, obovate, 4–7 mm long, apically notched. *Stamens* 10(12), fused basally and all on one side of the carpels; filament c. 1 mm long; anther narrowly oblong, 1.5–2 mm long, obtuse, opening by longitudinal slits; staminodes absent. *Carpels* 2, globular, densely hairy; style more or less erect, 1–1.5 mm long; ovules 4 per carpel. *Fruitlets* obovate, not seen mature. (Figure 3A–F)

Selected specimens examined (all PERTH): WESTERN AUSTRALIA: Newdegate, between Lake Grace and Lake King, 7 Nov. 1931, W.E. Blackall 1295; VCL Site 4 quadrat 1, just SW of Harrismith, 25 Nov. 1999, E. Bennett & T. Sleep 4.004; VCL Site 4 quadrat 1, just SW of Harrismith, 25 Nov. 1999, E. Bennett & T. Sleep 4.008; gravel pit, 500 m E of Dudinin on Kulin–Dudinin road, 7 May 1997, R. Davis 3135; both sides of Bendering Reserve Rd, 7.1 km W of its junction with Karlgarin Hill North Rd, 22 Sep. 2001, J.W. Horn 4109; Heathland Nature Reserve east of Lake Grace, along southern boundary, 14 Nov. 1994, E.D. Kabay 1064; Harrismith, edge of townsite on Wickopin–Harrismith road, 11 Oct. 2001, J.R. Wheeler 4144 (duplicates AD, K, MEL); Harrismith, on road to airfield, 11 Oct. 2001, J.R. Wheeler 4147; Harrismith, railway reserve, just N of townsite, 11 Oct. 2001, J.R. Wheeler 4150.

Distribution. Western Australia, South West Botanical Province, IBRA regions Avon Wheatbelt and Mallee. Recorded from Bendering and the Dudinin–Harrismith area east to Newdegate. (Figure 2B)

Habitat. Recorded from clay or loam and often gravelly soils in heath or shrubland.

Phenology. Flowers September to November, but also recorded for May.

Conservation status. Reasonably restricted in distribution, but occurring in a nature reserve where it was described as locally common.

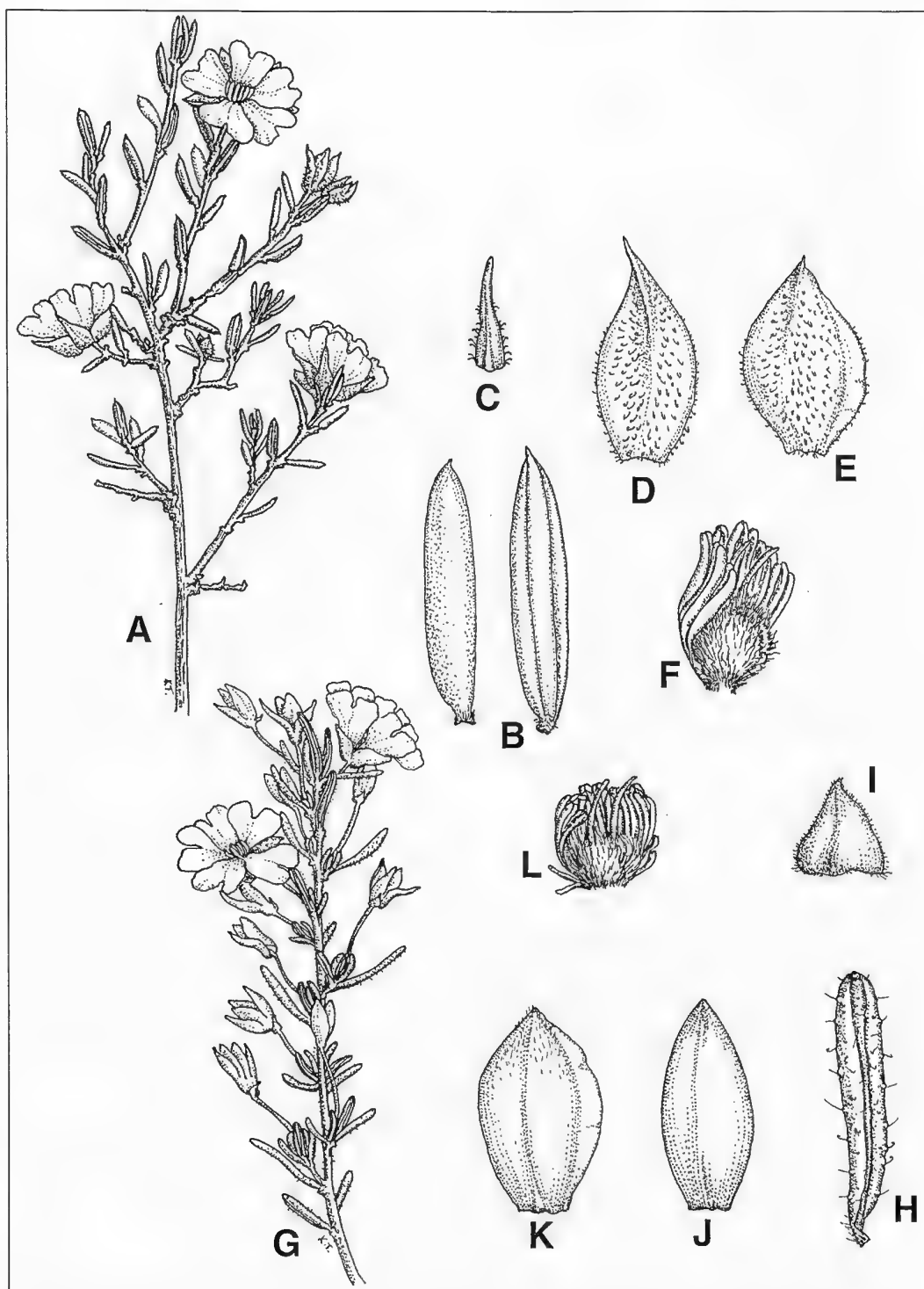


Figure 3. A–F. *Hibbertia ancistrotricha*. A – flowering branch (x2), B – leaf (x8), C – bract (x10), D – outer sepal (x8), E – inner sepal (x8), F – stamens and carpels (x8); G–L. *Hibbertia avonensis*. G – flowering branch (x2), H – lower surface of leaf (x8), I – bract (x10), J – outer sepal (x8), K – inner sepal (x8), L – stamens, staminodes and carpels (x10). Drawn by Kath Trafalski from J.R. Wheeler 4144 (A–F) and J.R. Wheeler 2618 (G–L).

Etymology. From the Greek *ancistron* – a fish hook and *trichon* – a hair, referring to the numerous uncinata hairs on the sepals.

Affinities. *Hibbertia ancistrotricha* belongs in section *Pleurandra*, having stamens all on one side of the 2 carpels and lacking staminodes. Often found growing with *Hibbertia acerosa* (DC.) Benth., which may also have uncinata hairs on the calyx and leaves, but *H. acerosa* has a longer leaf with a longer and more slender mucro, flowers with staminodes on each side of the fertile anthers and only 2 ovules per carpel.

Hibbertia avonensis* J.R. Wheeler, *sp. nov.

Species foliis brevibus crassis obtusis tuberculatis pilis dispersis strictis vel uncinatis, floribus breviter pedunculatis, sepalis exterioribus fere glabris, sepalis interioribus minute hirtis pilis simplicibus vel stellatis, staminibus 10(15) unilateralibus, staminodiis utrinque staminum, carpellis 2 pilosis 2-ovulatis.

Typus: c. 9 miles [14.2 km] east of Pingrup, Western Australia, 9 October 1971, *R.D. Hoogland* 12101 (*holo:* PERTH 03034224; *iso:* CANB, HBG, K, L, NSW, UC all *n.v.*).

Shrub to 0.6 m high; branchlets with minute simple hairs but soon glabrescent. *Leaves* spirally arranged, somewhat spreading, subsessile or with an indistinct petiole up to 0.5 mm long, narrowly oblong an thick, 2.5–8 mm long, 0.8–1.4 mm wide, margin revolute to a sunken midrib, the apparent margin rounded, upper surface tuberculate with a simple, long, straight to uncinata hair arising from each tubercle, the margin of the midrib apparently papillose, apex obtuse and minutely apiculate, the apiculum often downcurved. *Flowers* solitary in the upper axils or terminating very short axillary shoots, 7–13 mm diam.; peduncle 2–10 mm long, glabrous or with sparse appressed simple hairs. *Bracts* 1–3 at the base of the peduncle hidden amongst the leaves and 1 at the top of the peduncle immediately below the flower; uppermost bract ovate to broadly ovate, 1–2 mm long, base rounded to cordate, apex subacute to acute, margin ciliolate, otherwise glabrous. *Sepals* 5, basally fused, elliptic, subequal, 3.5–6 mm long; outer sepals 2–2.5 mm wide, subacute to obtuse, shallowly keeled, minutely ciliolate, otherwise glabrous apart from occasional sparse apical hairs; inner sepals broader, 2.5–3 mm wide, more obtuse, with minute appressed simple to semi-stellate or stellate hairs, margin thin and ciliolate. *Petals* 5, bright yellow, obovate, 4–8 mm long, deeply emarginate. *Stamens* 10(15), basally fused, all on one side of the carpels with 2 or 3 staminodes on each side of the stamens; filament c. 1 mm long; anther narrowly oblong, (1)1.5 mm long, obtuse or apiculate; staminode linear to subulate, 0.5–1.5 mm long. *Carpels* 2, more or less globular, 1–1.5 mm diam., white-hairy with simple hairs; style erect, 1.2–1.5 mm long; ovules 2 per carpel. *Fruitlets* obovate, c. 2.5 mm long, 1.5–2 mm wide; seed brown, globular, 1.5–2 mm diam. with a small waxy aril. (Figure 3G–L)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: Reserve 16262, Martagallup–Tenterden road, 12 km WNW of Kendenup, 21 Sep. 1993, *A.R. Annels* 3705; Reserve No. 19412, Site 3, N of Harrismith on both sides of the railway, within the Toolibin catchment, 24 Nov. 1999, *E. Bennett & T. Sleep* 19412.15; Quairading, 5 Oct. 1933, *W.E. Blackall* 3262; Tammin, Sep. 1922, *C.A. Gardner* 671a; Northam, Oct. 1900, *J.H. Gregory s.n.*; N side of the Great Eastern Highway, 4.0 km W of its junction with Tammin–Wyalkatchem Road in Tammin, 1 Sep. 2001, *J.W. Horn* 4029 (duplicate DUKE *n.v.*); W side of Ralston Rd, 14.25 km S of its junction with Goldfields Rd, Charles Gardner Reserve, 1 Sep. 2001, *J.W. Horn* 4032 (duplicate DUKE *n.v.*); Tammin National Park, 15 miles [24 km] S of Tammin, 2 Aug. 1968, *R.D. Royce* 8429; 4 km W of Tammin along Great Eastern Highway, 15 Sep.

1982, A. Strid 20304; 9 km W of Northam, 23 Sep. 1988, J.R. Wheeler 2618 (duplicates AD, CANB, MEL).

Distribution. Western Australia, South West and Eremaean Botanical Provinces, IBRA regions Avon Wheatbelt and Jarrah Forest. Recorded from Northam and Tammin to Pingrup with a southerly record from near Kendenup. (Figure 2C)

Habitat. Occurs in heath, shrubland or occasionally in woodland, predominantly on sand but with occasional records from loam or gravelly clay.

Phenology. Flowers recorded August to October, fruits recorded for November.

Conservation status. Fairly widespread, not believed to be under threat.

Etymology. The name of this species reflects its occurrence in the southern wheatbelt and is almost entirely restricted to the Avon Wheatbelt region.

Affinities. With all its stamens on one side of 2 carpels and with the presence of staminodes *Hibbertia avonensis* belongs in the section *Hemipleurandra*. Previously often included in *Hibbertia gracilipes* Benth. to which it is similar in its small thick leaves which are obtuse and somewhat apiculate, its pedunculate flowers and 2-ovulate carpels but differs in its indumentum, stamens and staminodes. *Hibbertia gracilipes* has glabrous leaves and sepals, longer peduncles, apiculate anthers and lacks staminodes.

Note. One of the specimens of *Hibbertia avonensis* was recognised as distinct over 70 years ago by C.A. Gardner who annotated a specimen (Gardner 671a) by the manuscript name "*Hibbertia gracilipes* var. *tamminensis* Gardner" with a short Latin diagnosis dated 19 December 1929 and a note saying "Form of *H. gracilipes* or a new species". However I can find no publication of this name.

***Hibbertia lepidocalyx* J.R. Wheeler, sp. nov.**

Species foliis strictis mucrone recto pungenti ad apicem instructis, floribus pedunculatis, sepalis lepidotis, staminibus 9–10 unilateralibus, staminodiis absentibus, carpellis 2 lepidotis 4–6-ovulatis.

Typus: 7 km east of Lake King township, Western Australia, 9 August 1968, P.G. Wilson 6951 (*holo:* PERTH 04395654; *iso:* AD, K).

Shrub to 0.75 m high; branchlets glabrous apart from sparse stellate hairs on very young growth. *Leaves* spirally arranged, sometimes forming clusters on short shoots; petiole 0.5–1 mm long, upper surface with tiny hairs, the lower surface with dense appressed scales; blade rigid, linear but thick with margins revolute to the midrib, (5)6–20 mm long, 1–1.5 mm wide, leaf surface smooth or tuberculate, glabrous or with very sparse minute stellate or v-shaped semi-stellate hairs towards the base, apparent leaf margin thick and rounded, apex with a straight pungent mucro 0.5–1 mm long. *Flowers* solitary, axillary, 8–25 mm diam., pedunculate and sometimes at length nodding; peduncle 4–15 mm long, with sparse stellate hairs; *Bracts* several at base of peduncle and 1 immediately below flower; uppermost bract ovate, 2–3.2 mm long, acute, outside covered with dense scales, margin minutely fringed. *Sepals* 5, basally fused, ovate to elliptic, subequal, 4–7 mm long, 2.5–5 mm wide, outside covered with scales,

the inside of the outermost sepals with minute appressed hairs; outer sepals subacute to obtuse; inner sepals obtuse, broader with a thin glabrous but minutely ciliolate margin. *Petals* 5, yellow, obovate, 5–12 mm long, deeply emarginate. *Stamens* 9–10, all on one side of the carpels and basally fused; filament 0.5–1.5 mm long; anther narrowly oblong, 1.5–2 mm long; staminodes absent. *Carpels* 2, more or less ovoid, densely covered with appressed scales whose margins are sometimes fringed; style 1–2 mm long, with sparse stellate hairs towards the base; ovules 3–6. *Fruitlets* obovoid, c. 3 mm long, 1.8 mm wide; seeds brown, ellipsoid, c. 2 mm long, c. 1.3 mm wide, with a small waxy aril, often only one maturing.

Etymology. From the Greek *lepidos* – scale and *calyx* – covering of a flower or fruit, referring to the scales covering the calyx.

Affinities. *Hibbertia lepidocalyx*, with its stamens all on one side of the 2 carpels and the absence of staminodia, belongs in section *Pleurandra*. Related to *Hibbertia eatoniae* Diels, with similar pedunculate flowers, sepals covered in scales and carpels each with 4–6 ovules. However *H. eatoniae* has smaller leaves with occasional scabrous hairs and a distinctly recurved mucro. The indumentum of both the sepals and carpels but particularly the carpels in *H. eatoniae* approaches that of stellate hairs with a fused centre rather than fringed scales.

Notes. Two subspecies are recognised.

Key to subspecies of *Hibbertia lepidocalyx*

1. Leaf surface apparently smooth. Flowers 8–15 mm diam. (Mallee region) ... subsp. **lepidocalyx**
1. Leaf surface distantly tuberculate. Flowers 15–25 mm diam.
(Coolgardie region) subsp. **tuberculata**

Hibbertia lepidocalyx subsp. **lepidocalyx**

Leaves appearing smooth, up to 15 mm long, 1–1.4 mm wide, mucro c. 0.5 mm long. *Flowers* 8–15 mm in diameter. *Sepals* 4–7 mm long, 2.5–3 mm wide; outer sepals subacute. *Petals* 5–9 mm long. *Ovules* 3 or 4(5) per carpel. (Figure 4A–F)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: E side of gridline (and W of mine waste dump) just N of crossroads c. 250 m NW of Hatter Hill, 5 Sep. 1996, *N. Gibson & K. Brown* 2521 (duplicate AD); on N side of gridline just off Middle Ironcap Rd, c. 400 m E of South Ironcap, 7 Sep. 1996, *N. Gibson & K. Brown* 3055; to the S of gridline, 100 m E of Middle Ironcap Rd, c. 600 m E of South Ironcap, 7 Sep. 1996, *N. Gibson & K. Brown* 3056; to W of cleared strip, c. 50 m E of Hatter Hill, 3 Sep. 1996, *N. Gibson & K. Brown* 3057; N side of Bendering Reserve Rd, 2.4 km SW of its junction with Narembreen South Rd, Shire of Kondinin, 22 Sep. 2001, *J.W. Horn* 4106 (duplicate DUKE *n.v.*); powerline right-of-way running in a N–S direction on the N side of Lake King–Norseman road, 1.4 km E of its junction with Hyden–Lake King road in Lake King, 24 Sep. 2001, *J.W. Horn* 4118 (duplicate DUKE *n.v.*); Baanga Hill, E of Lake King, 11 Aug. 1986, *R.A. Saffrey* 445; 3.1 km E of Lake King on road to Norseman, 21 Sep. 1986, *J.R. Wheeler* 2415 (duplicate MEL); near Baanga Hill, junction of Hatter Hill Rd and Baanga Hill Rd, 22 Sep. 1986, *J.R. Wheeler* 2421 (duplicate CANB); lower east-facing slopes of South Ironcap at HYD66 benchmark, 7 Sep. 1999, *J.R. Wheeler* 3964 (duplicates MEL, NSW).

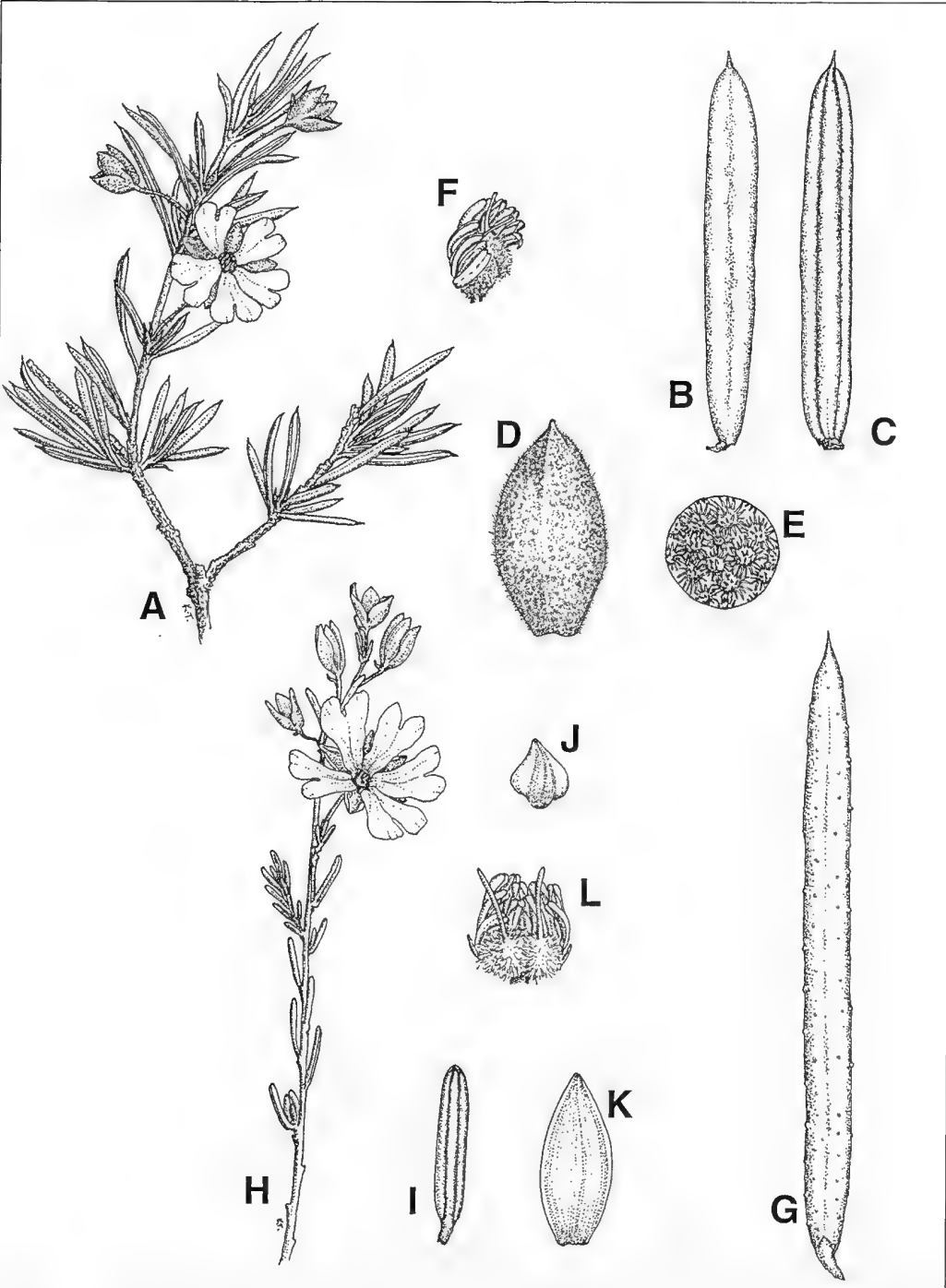


Figure 4. A–F. *Hibbertia lepidocalyx* subsp. *lepidocalyx*. A – flowering branch (x2), B – upper surface of leaf (x8), C – lower surface of leaf (x8), D – outer sepal (x8), E – enlargement of sepal indumentum (x20), F – stamens and carpels (x8); G – *Hibbertia lepidocalyx* subsp. *tuberculata*, upper surface of leaf (x8); H–L. *Hibbertia stenophylla*. H – flowering branch (x2), I – lower surface of leaf (x8), J – bract (x20), K – outer sepal (x8), L – stamens, staminodes and carpels (x10). Drawn by Kath Trafalski from J.R. Wheeler 2416 (A–F), Gibson & Lyons 3748A (G), C. Robinson 532 and J.S. Beard 4676 (H–L).

Distribution. Western Australia, South West Botanical Province, IBRA region of Mallee. Recorded from Bendering and east of Lake King, from South Ironcap to Baanga Hill. (Figure 5A)

Habitat. Recorded in open mallee or shrubland on lateritic soil over laterite, or sandy loam or sandy clay with lateritic gravel.

Phenology. Flowers recorded August to September; occasional fruits recorded in September.

Conservation status. Locally quite common, not believed to be under threat.

Hibbertia lepidocalyx* subsp. *tuberculata J.R. Wheeler, *subsp. nov.*

Subspecies haec a subsp. *lepidocalyce* foliis tuberculatis et floribus grandioribus differt.

Typus: on north side of track between Kurrajong and Pittosporum rockholes, c. 17.2 km north-north-west of Mt Dimer, Hunt Range, Jaurdi Station, Western Australia, 18 July 1995, *N. Gibson & M. Lyons* 2507 (*holo:* PERTH 05293731; *iso:* AD, CANB, K).

Leaves up to 20 mm long, 1.2–1.5 mm wide, distantly tuberculate, each small tubercle topped by a microscopic stellate or semi-stellate hair, apex a mucro 0.5–1 mm long. *Flowers* 15–25 mm diam. *Sepals* broadly elliptic, 6.5–7 mm long, 3.5–5 mm wide, all obtuse. *Petals* 9–12 mm long. *Ovules* (5)6 per carpel. (Figure 4G)

Other specimens examined (all PERTH). WESTERN AUSTRALIA: N side of track c. 10.3 km NE of Bungalbin Hill, Aurora Range, 24 July 1995, *N. Gibson & M. Lyons* 2790; 100 m N from end of track c. 8.5 km NE of Bungalbin Hill, Aurora Range, 24 July 1995, *N. Gibson & M. Lyons* 2881; ridge c. 1.5 km N of Bungalbin Hill, 23 July 1995, *N. Gibson & M. Lyons* 3748A (duplicate MEL).

Distribution. Western Australia, Eremaean Province, IBRA region of Coolgardie. Recorded only from the Aurora Range and the Hunt Range. (Figure 5A)

Habitat. Recorded from woodland and heath on loam soils of a banded ironstone ridge.

Phenology. Flowers recorded for July; mature fruits not seen.

Conservation status. Conservation Codes for Western Australian Flora: Priority One. Apparently restricted in distribution and in need of surveying.

Etymology. From the Latin *tuberculatus* – tuberculate, referring to the wart-like projections on the upper surface of the leaves.

Affinities. *Hibbertia lepidocalyx* subsp. *tuberculata* differs from the typical subspecies in its slightly longer leaves with distinct small tubercles and its somewhat larger flowers with broader more obtuse sepals. The rank of subspecies has been chosen for this taxon as it is geographically distinct from subsp. *lepidocalyx*.

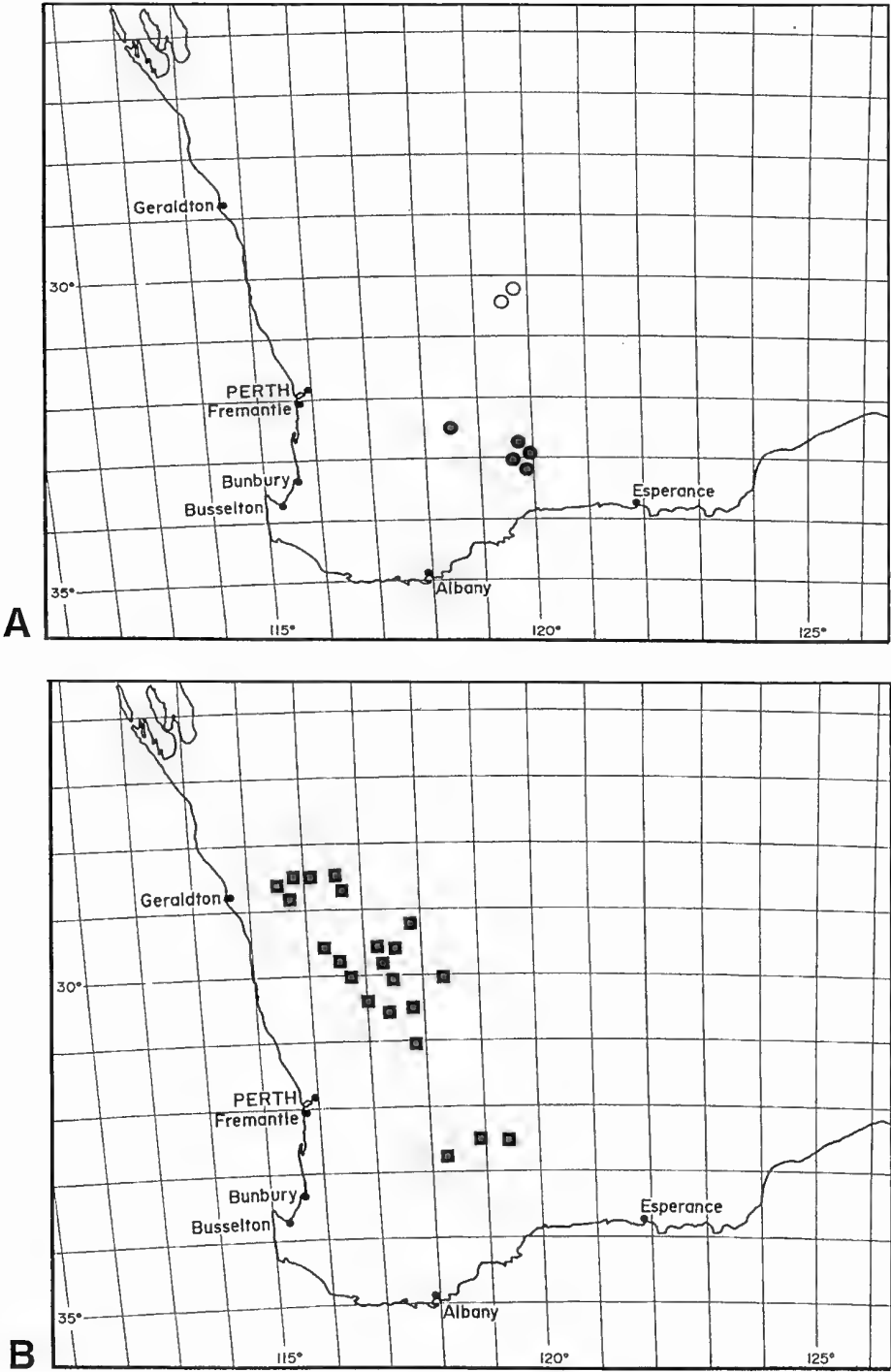


Figure 5. Distribution maps. A – *H. lepidocalyx* subsp. *lepidocalyx* ● and *H. lepidocalyx* subsp. *tuberculata* ○ ; B – *H. stenophylla*.

Hibbertia stenophylla* J.R. Wheeler, *sp. nov.

Species foliis angustis obtusis, marginibus recurvis ad costam depressam; floribus breviter pedunculatis, bractea cordata, sepalis glabris, staminibus 10 unilateralibus, staminodiis utrinque staminum, carpellis 2 pilosis 3–4-ovulatis.

Typus: on west side of Black Rd, 1.3 km north of intersection with Glamroff Rd in locality of Goodlands, c. 61 km north-east of Kalannie, Western Australia, 30 July 1994, *M. Hislop* 31 (*holo*: PERTH 04306171; *iso*: AD, K).

Shrub to 0.6(1) m high; branchlets glabrous. *Leaves* spirally arranged, shortly petiolate, usually antrorsely directed, rarely spreading; petiole (0.3)0.5–1 mm long, glabrous; blade linear but thick and appearing terete, (1.5)2.5–9(12) mm long, 0.5–0.8(1.5) mm wide, glabrous, smooth or very minutely tuberculate, margins revolute to a sunken midrib, apparent margins rounded, apex obtuse and sometimes minutely apiculate. *Flowers* solitary in the upper axils or terminating short shoots, shortly pedunculate, (5)10–15(20) mm diam.; peduncle 1–4.5 mm long, rarely apparently absent in immature flowers, glabrous. *Bracts* 2–4 at the base of the peduncle and 1 immediately below flower; uppermost bract broadly ovate and cordate, with a dark and somewhat keeled midline and paler margins, 0.5–0.8(1.2) mm long, 0.7–1 mm wide, glabrous, margin irregularly indented and rarely minutely ciliate, apex acute to subacute. *Sepals* 5, basally fused, subequal or the innermost slightly longer, 4–6 mm long, glabrous with a distinct pale margin, obtuse; outer sepals elliptic, 2–3 mm wide; inner sepals broadly elliptic, 3–4.5 mm wide. *Petals* 5, yellow, obovate, (3)5–10(12) mm long, the apex deeply notched. *Stamens* 10 all on one side of the carpels, basally fused, usually with 1–3 staminodes on each side of the stamens; filament c. 1 mm long; anther narrowly oblong, c. 1.5 mm long, obtuse; staminodes subulate, 1–1.5 mm long, usually lacking an anther. *Carpels* 2, more or less globular, densely hairy with simple white hairs; style erect, 1.5–2 mm long, sometimes hairy towards the base; ovules 3 or 4 per carpel. *Fruitlets* obovoid to oblong obovoid, 2.5–3.5 mm long, c. 1.5 mm wide, hairy; seeds 1 or 2 maturing per carpel, brown, globular, 1.5–2 mm diam., partly surrounded by a large waxy aril which often extends about halfway up the seed. (Figure 4H–L)

Selected specimens examined (all PERTH). WESTERN AUSTRALIA: between Latham and Maya, 3 Sep. 1938, *W.E. Blackall* 3750; 40 km E of Mullewa on road to Yalgoo, 14 May 1968, *H. Demarz* 50; 20 km S of Rabbit Proof Fence near Emu Rock, 17 Sep. 1976, *R.J. Hnatiuk* 760857; SW side of Struggle St, 2.2 km N of junction with Kalannie Road, Shire of Dalwallinu, 15 Sep. 1999, *J.W. Horn* 2459 (duplicate DUKE *n.v.*); road between Mullewa and Morowa, c. 10 km S of Mullewa, 9 Aug. 1973, *A. Kanis* 1614 (duplicate CANB *n.v.*); western boundary of Badja Station [south of Yalgoo], 27 June 1993, *A.L. Payne* 3613; 19 km E of Karroun Hill, 1983, *P. Roberts* 224; 30 km E of Dalwallinu on road to Kalannie, 19 Sep. 1988, *J.R. Wheeler* 2575 (duplicates AD, CANB, MEL); 5 km W of Mollerin on Burakin–Wialki road, 20 July 1989, *J.R. Wheeler* 2632 (duplicates AD, K, MEL, NSW); near Lake Moore, E side, c. 51 km N of Cleary, 2 Sep. 1967, *P.G. Wilson* 6123 (duplicate MEL).

Distribution. Western Australia, South west and Eremaean Botanical Provinces, IBRA regions Avon Wheatbelt, Murchison, Yalgoo and Coolgardie. Recorded from Mullewa and Yalgoo east to Karroun Hill and south to Kulin and near Hyden. (Figure 5B)

Habitat. Recorded from heath and shrubland on a variety of soils.

Phenology. Flowers recorded May to September; fruits from September.

Conservation status. Widespread, not believed to be under threat.

Etymology. From the Greek *stenos* – narrow and *phyllon* – leaf, referring to the small narrow leaves.

Affinities. With the stamens all on one side of the carpels and the presence of staminodes this species belongs to section *Hemipleurandra*. It is possibly related to *Hibbertia crassifolia* (Turcz.) Benth., but with the foliage and sepals completely glabrous, with shortly pedunculate flowers and 3- or 4-ovulate carpels. Superficially resembling some forms of *Hibbertia gracilipes* Benth. but differing in its obtuse anthers and presence of staminodes, the 3- or 4-ovulate carpels and in the form of the leaves which, in *H. gracilipes*, are tightly revolute to a somewhat enlarged midrib.

Notes. A single flower was noted with 3 carpels, but the third carpel was withered and probably infertile. One collection (*F.M. Sharr s.n.*) from Pindar had 6 staminodes outside the fertile stamens rather than 1–3 each side.

Acknowledgements

I should like to thank the Director and staff of the Western Australian Herbarium for access to the state collection. Thanks to Paul Wilson for preparing the Latin diagnoses. Thanks also to Kath Trafalski and Glenn Rodrigues for their fine illustrations.

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Short Communication

Lectotypification of two Western Australian species of *Micromyrtus* (Myrtaceae)

Among the species of *Micromyrtus* Benth. (Myrtaceae) that Bentham (1867) described in “Flora Australiensis”, were two Western Australian species that had previously been recognised as distinct taxa by Ferdinand von Mueller. One had been described as *Thryptomene elobata* (Mueller 1864) and another had been given the manuscript name *T. racemosa* F. Muell. The purpose of this short communication is to select a lectotype from among the syntypes of each of these species.

Micromyrtus elobata (F. Muell.) Benth., Fl. Austral. 3, 64 (1867). – *Thryptomene elobata* F. Muell., Fragm. Phyt. Austral. 4: 63 (1864). *Type citation*: “In locis arenosis apud sinum Israelite Bay. Maxw.”. *Type*: sandy places inland of Israelite Bay, [Western Australia], G. Maxwell (*lecto*: MEL 71324, here designated). *Excluded syntype*: Israelite Bay, [Western Australia], G. Maxwell (MEL 71325).

Lectotypification. Following requests for type material, two specimens were received from MEL (72324 & 71325) and one from K. All three specimens appeared to be from separate collections. Both of the MEL sheets had a corner of the label turned over and labelled with a B, indicating that they had been examined by Bentham and both had *Thryptomene elobata* written on the label in Mueller’s handwriting. The MEL 71324 sheet, selected here as the lectotype, had leafy stems with a good number of flowers, and its locality given as “Sandy places inland” as well as referring to Israelite Bay. The other MEL sheet had a specimen with much more widely spreading, largely bare branches, with a few leaves and flowers crowded at the end of each branchlet, and a label with the less precise locality “Israelite Bay”.

The K material, from Herbarium Hookerianum, was very different again in appearance, for example having larger leaves than both MEL specimens, and it is very unlikely that it had been seen by Mueller. It was labelled with a different locality, Young River, and had two possible collectors names, Oldfield and Maxwell. It is clearly not part of the type collection of *Micromyrtus elobata*.

Micromyrtus racemosa Benth., Fl. Austral. 3, 64 (1867). *Type*: south-western Australia, J. Drummond coll. 2, n. 235 (*lecto*: K Herbarium Hookerianum sheet, here designated; *isolecto*: K (two sheets), MEL 71359). *Excluded syntype*: Murchison River, [Western Australia], A.F. Oldfield (K; MEL 71357, 71358).

Lectotypification. The unpublished name *Thryptomene racemosa* F. Muell. ms. was cited by Bentham (1867: 64), who adopted Mueller’s epithet but placed it in a different genus when he named *Micromyrtus racemosa*. The first of the two syntypes cited by Bentham, “Drummond, 2nd Coll. n. 235”, seems to be the more appropriate one to use to select the lectotype for the species as it is of good quality and more duplicates of it are known than for the collection by Oldfield. Of the three sheets of this collection examined from K, the one from Herbarium Hookerianum has the most copious material and would have been examined by Bentham, who worked extensively on Hooker’s herbarium specimens. Hence this specimen is selected here as the lectotype. The *isolectotypes* examined include a specimen from MEL.

The excluded syntype is represented at MEL by two sheets (71357, 71358) and at K by a single sheet from Herbarium Hookerianum. Both MEL sheets are identified as *Thryptomene racemosa* and have a B written on a folded corner of the main label, indicating the Bentham had examined them, and MEL 71357 has, in addition to this, a large label with detailed descriptive notes in Mueller's handwriting.

Locality of lectotype. Judging from the information on Drummond's collections given in Erickson (1969), it seems likely that the lectotype was collected in the Wongan Hills area. Of the PERTH collections from that area, the one showing the closest resemblance to the lectotype is *R.D. Royce* 6636.

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Corrections to *Nuytsia* Volume 14

The publication date given for *Nuytsia* Volume 13(3) was given on page 316 of Volume 14 as 15 January 2002 but should have been 8 January 2002 as given in the Cumulative Index to Volume 13.

On page 375, *Laxmannia morrisii* was incorrectly referred to as *L. morrisonii*. This species was named in honour of Dennis I. Morris, who was incorrectly referred to on page 378 as D.S. Morris and later as Desmond Morris.

CONSERVATION CODES FOR WESTERN AUSTRALIAN FLORA

R: Declared Rare Flora – Extant Taxa (= Threatened Flora = Endangered + Vulnerable)

Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such, following approval by the Minister for the Environment, after recommendation by the State's Threatened Species Scientific Committee.

X: Declared Rare Flora – Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such, following approval by the Minister for Environment, after recommendation by the State's threatened Species Scientific Committee.

1: Priority One – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two – Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three – Poorly Known Taxa

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey.

4: Priority Four – Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5–10 years.

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